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PETHERBRIDGE (F. R.) & STAPLEY (J. H.). **Two important Wheat Pests.**—*Agriculture* **51** no. 7 pp. 320–324, 1 fig. London, 1944.

Brief accounts are given of the bionomics of *Hylemyia* (*Leptohylemyia*) *coarctata*, Fall. [*cf.* *R.A.E.*, A **10** 366] and *Helophorus nubilus*, F. [*cf.* **24** 794], which caused serious injury to winter wheat in eastern England in early 1944. The adults of *Hylemyia* occur from June to August and oviposit in bare or sparsely covered soil. Most of the eggs do not hatch till the following February. The larvae attack couch grass [*Agropyrum repens*] and autumn- and winter-sown wheat, rye and barley, but not oats, and pupate in the soil in late April or early May. They resemble those of *H.* (*Chortophila*) *sepia*, Mg., which occur in wheat in late May and June, but the latter are rarely common enough to be injurious. In 1944, attack was most frequent on wheat following potatoes or sugar-beet ; damage also occurred after leys of rye-grass [*Lolium*] and clover that were ploughed up or cultivated in July, but not where the previous crop covered the soil densely during July and early August. The cultivation of green manure crops on land that would otherwise lie fallow between July and early September is therefore recommended [*cf.* **16** 622]. Observations in 1944 indicated that wheat sown before mid-October, so that it can produce abundant tillers before winter, or after 1st March, when the eggs of the fly have hatched, is least liable to serious damage. On black fen soil, which permits late sowings to tiller freely, the percentage of infested shoots in wheat sown on 20th November and 22nd January was 13 and 61, respectively. The November sowing had tillered considerably, but the January one was still in the single-shoot stage. None of 14 varieties of wheat tested was resistant to attack. In the early stages of infestation, recovery can be assisted by rolling to consolidate the soil and assist tillering and by applying nitrogenous fertilisers in early spring ; severely-attacked crops should be ploughed up early in April and replaced immediately with barley before weeds become established. Barley can also be used to replace infested patches of wheat ; oats sown so late are liable to attack by the frit fly [*Oscinella frit*, L.].

Injury by *Helophorus nubilus* bears a superficial resemblance to that caused by wireworms, but occurs earlier in the year (from January to early April). Wheat is especially liable to attack by this Hydrophilid when it follows leys, particularly of rye-grass and clover, that are not ploughed until September or October, but damage also occurs after sainfoin and trefoil, and occasionally after other cereals. Wheat on newly-ploughed grassland was not damaged, although larval populations of 25,000 per acre were recorded ; in damaged wheat following leys, populations averaged 300,000 per acre. Wheat sown in early October has tillered and formed secondary roots before the main attack begins and is able to withstand infestation. Damage usually occurs on light or medium soil. When wheat was sown in parts of a field that had previously been under sainfoin, it was damaged by *H. nubilus* and larval populations of 375,000 per acre were found to be present ; the wheat sown on 15th October produced a good stand, however, while that sown on 3rd November failed. Wheat sown on the latter date in a part of the field that had been under peas was not injured. Recommendations against *H. nubilus* include ploughing short leys on land to be sown with wheat not later than August, sowing before mid-October on firm soil, and ploughing under badly attacked crops at the end of March and resowing with barley.

GAUTIER (C.). **Les éclosions annuelles de la bruche des pois.**—*Bull. mens. Soc. linn. Lyon* **11** no. 10 pp. 155–156, 4 refs. Lyons, 1942. **Du nouveau sur la bruche des pois.**—*Op. cit.* **12** no. 3 p. 47. 1943. **Sur la bruche des fèves, *Bruchus rufimanus*, Schoenh.**—*T.c.* p. 48. [Recd. 1945.]

Peas harvested in France in June 1942 yielded some adults of *Bruchus pisorum*, L. (*pisi*, L.) in August, but some of the peas were found to contain living adults when opened in October and December. Soaking the peas in vinegar-water induced emergence. Similar observations are recorded in the third paper for *B. rufimanus*, Boh., in broad beans [*Vicia faba*].

BOCZKOWSKA (M.). **Observations sur le doryphore** (*Leptinotarsa decemlineata* **Say) à Saint-Genis-Laval (Rhône), en 1942 et 1943.**—*Bull. mens. Soc. linn. Lyon* **13** no. 10 pp. 134–138, 3 refs. Lyons, 1944.

Leptinotarsa decemlineata, Say, has been present on potato in the district of Lyons since 1933, but has not caused much damage. Observations on its seasonal history in potato fields were carried out in 1942 and 1943, in both of which years the summer temperature was above and the rainfall below the average. In 1942, oviposition began about 18th May, the larvae hatched from 25th May, and a single treatment of the fields in early June afforded control. In 1943, however, oviposition began on 7th and hatching on 14th May. Treatment was applied at the end of the month, but large numbers of adults appeared in July and oviposited on late potatoes. Larvae appeared in these fields at the end of July and, though treatment was again applied, persisted throughout August and September. Adults appeared again at the beginning of September and were present until harvest in October. Comparative data on the numbers of eggs and larvae present in the two years are shown in tables. The outbreak in 1943 was thought to be due chiefly to the unusual weather in two consecutive years, and to the absence in the early part of the season of Opilionid spiders, which had destroyed many of the eggs in 1942 before the appearance of other predators. The second generation was reduced by the predators, *Zicrona coerulea*, L., *Chrysopa vulgaris*, Schn., *Trombidium* sp. and the spider, *Theridium lineatum*, L.

RUIZ CASTRO (A.). **Fauna entomológica de la vid en España. Estudio sistemático-biológico de las especies de mayor importancia económica.** [The Insect Fauna of Grape-vines in Spain. Studies of the Systematics and Bionomics of the Species of major economic Importance.]—150 pp., 10 pls. (2 fldg., 3 col.), 54 figs., 3 pp. refs. Madrid, Inst. esp. Ent., 1943. [Recd. 1945].

This book contains four sections, of which the first comprises an account of the history and importance of viticulture in Spain, the second a brief discussion of the relationships between insects and their food-plants and the influence of ecological factors on the insect fauna of vineyards, and the third a systematic list of over 80 insects that have been observed on grape-vines in that country, with the localities from which they were recorded. The fourth (pp. 39–143) contains a list of the 13 more important insect pests of grapes in Spain, keys to the larvae and adults of the Tortricids and Sphingids included in the preceding section, and accounts of the morphology of various stages, distribution, bionomics and economic importance of *Sparganothis pilleriana*, Schiff., *Polychrosis botrana*, Schiff., *Clysiana* (*Clysia*) *ambiguella*, Hb., and *Celerio lineata* var. *livornica*, Esp., and of the synonymy, the food-plants, and the various factors that influence the numbers of the first three.

Termite-proofing of Timber for Use in the Tropics.—*Leafl. For. Prod. Res. Lab.* no. 38, 6 pp., 16 refs. Princes Risborough, Bucks., 1944.

This leaflet, which is based on the literature and intended for British manufacturers handling timber or making furniture, etc., for use in countries where termites occur, comprises a brief account of how termite damage takes place and how it may be prevented. Notes are given on the habits of subterranean, mound-building and dry-wood termites and the prevention of damage by the proper construction of buildings [*cf. R.A.E.*, A **31** 30, etc.] and by soil poisoning [*cf.* **30** 389, **33** 69], on the use of timber treated with wood preservatives [*cf.* **32** 29, 242] or of termite-resistant woods and on the protection of fibre or composition boards [*cf.* **32** 243) and of plywood (by means of aqueous solutions of arsenicals, zinc chloride or sodium fluoride). Tests have shown that boards or other structural products that contain cellulose held together with a plaster binder of fine cement are resistant to attack by termites, and there is some evidence to suggest that when plywood is made up with adhesives of phenolic resins, these may act as a barrier preventing or delaying the passage of termites through the wood.

PEIRIS (J. W. L.). **A Leaf Curl Disease of Tomato and its Relation to some other Plants.**—*Trop. Agriculturist* **100** no. 1 pp. 14–19, 2 pls., 8 refs. Peradeniya, 1944.

Tomatos in Ceylon have from time to time been reported as suffering from stunted growth, curling and bronzing of the leaves, and sometimes die-back, resulting in the death of the plants. This condition was at first attributed to a virus or to nutritional deficiency, but it is here shown to be due to unidentified mites. The symptoms, which may appear at any time after the first leaves have expanded, are most conspicuous at the ends of the shoots, but may also affect older leaves as well as the stems and fruit. The most typical features are the glossy appearance, followed by bronzing, of the lower surface of infested leaflets, which may later extend to the upper surface, and the downward curling of the leaflets and leaf stems. In the later stages, the leaflets become thickened, brittle and scale-like, and the skin of infested fruits becomes russet-coloured, corky and cracked.

The mites are not visible to the naked eye, but occur in large numbers on the lower surface of the leaves ; no other organisms were present and the roots of affected plants were normal. Ten healthy seedlings that were sprayed with a sulphur spray, kept in insect-proof cages for three weeks and then infested with mites from affected plants developed marked symptoms five days later ; after a further four days, die-back of the terminal shoots was noted on seven of the seedlings. Half the plants were then sprayed with a sulphur spray, and on the following day almost all the mites on them were found to be dead. These plants were then sprayed again and returned to the cages. A fortnight later, they had all developed new healthy foliage, whereas the infested plants that had not been sprayed were stunted and any new foliage that had been produced showed typical symptoms.

Infestation is commonest during the dry months and spreads in the fields from small foci to large patches. Heavy rain checks spread, probably by washing the mites off the plants. The mites may be distributed by human agency or by insects, particularly ants. They can be controlled by sprays or dusts of sulphur applied when the symptoms first appear, but if infestation is severe, the curled leaves should be removed before treatment.

Malformations similar to those described for tomato occur frequently on other plants infested by mites in Ceylon, including chilli (*Capsicum annuum*), in which the loss of crop may exceed 50 per cent., and cowpea. When mites were transferred from these plants to healthy tomato plants in cages, incipient symptoms resembling those produced by mites from infested tomato plants appeared in four days and severe symptoms in ten. Other plants that exhibited characteristic symptoms and were found to be infested with mites were Cape gooseberry (*Physalis peruviana*), a spinach (*Basella alba*), dambala (*Psophocarpus tetragonolobus*), potato and tobacco.

Other records of malformation of solanaceous plants caused by the feeding of mites or insects in different countries are discussed [*R.A.E.*, A **23** 511 ; **27** 493, 494]. The condition described in this paper is similar to the so-called tambera disease of potato and the murda disease of chilli in India, with both of which mites are associated. An upward leaf-curl of tomato in Ceylon is caused by a virus, but the plants do not as a rule die.

GADD (C. H.). **Report of the Entomologist for 1943.**—*Bull. Tea Res. Inst. Ceylon* no. 25 pp. 32–37, 4 refs. Talawakelle [1944].

The results are given of observations on insect pests of tea in Ceylon in 1943 and of an investigation on the shot-hole borer [*Xyleborus fornicatus fornicatior*, Egg.] that has already been noticed [*R.A.E.*, A **33** 294]. *Homona coffearia*, Nietn., was reported from five estates during the year, but attack was not severe, and the Braconid, *Macrocentrus homonae*, Nixon, was common in collections that were received from three of them. This parasite has become well-established [*cf.* **30** 418] and gives effective control. The ovipositing females attack the host larvae only when these are in webbed leaves, but cannot distinguish webbed leaves that contain larvae from those that do not. The ovipositor is inserted at random through holes and crevices and cannot pierce the leaves. Generally, only one egg is deposited in a host, but the eggs are polyembryonic, and about 28 larvae result from each.

Nettle grubs [Limacodids] were reported from eight estates during the year [*cf.* **32** 250], the species concerned being *Natada nararia*, Moore, and *Parasa lepida*, Cram., but attacks were not extensive or severe. Collections from an acre of tea at Passara were made weekly until June and then at intervals of a fortnight, and 40 bushes were examined on each occasion. Larvae were found on 34 of the 35 visits, the average per collection being 6·6, but *P. lepida* was not among them. The species found, in order of abundance, were *N. nararia*, which was taken on 29 occasions, the average per collection being 4·1, *Thosea* sp., which appeared in March and was most abundant in September, *Narosa conspersa*, Wlk., and *Spatulifimbria castaneiceps*, Hmps. The Eulophids previously recorded as attacking the larvae of Limacodids [**32** 250], particularly *Natada nararia*, were frequent during the year and were identified as *Neoplectrus maculatus*, Ferrière, and *Platyplectrus natadae*, Ferrière. *N. maculatus* was the commoner and is evidently of importance in control. The Braconid, *Fornicia ceylonica*, Wlkn., was observed occasionally, but its effectiveness is limited by an unidentified hyperparasite of the genus *Ceraphron*. A single larva of *Natada nararia* was found to be attacked by wilt [*cf.* **32** 250], but this disease is evidently of minor importance when populations are low. Small collections of *Parasa lepida* were received from five estates, and the Braconid, *Apanteles parasae*, Rohw., was bred from them. *P. lepida* is more easily controlled than other nettle grubs, since its gregarious habits facilitate hand-collection.

Other insects recorded during the year included *Heterobostrychus aequalis*, Waterh., in plywood for tea chests, and the Ichneumonid, *Paniscus laevis*, Cam., of which swarms, consisting chiefly of males, were observed round tea bushes during November and the beginning of December. No insect that might have served as a host for this parasite was found on the bushes, and it did not attack cutworms in the laboratory.

LAL (K. B.). **Prevention of Damage to stored Potatoes by the Potato Tuber Moth.**—*Curr. Sci.* **14** no. 5 p. 131, 2 refs. Bangalore, 1945.

In view of Rahman's work [*R.A.E.*, A **32** 305], an experiment on similar lines was carried out in the laboratory at Cawnpore. Heaps of 16 potatoes were kept covered from 14th September 1944 to 2nd March 1945 with sand, ash, sawdust, chaff, ash mixed with lime or the leaves of two plants, and one lot was left uncovered as control. All lots were exposed equally to infestation by *Gnorimoschema operculella*, Zell. Potatoes covered with sand, ash and ash mixed with lime remained free from attack, but the others were heavily infested. The percentages of infested and rotten potatoes were 91 and 47·9 under leaves of *Lantana* and 0 and 8·3 under sand.

ARNOLDI (K. V.). **On the Food Relations of *Eurygaster integriceps* in the Highland and western Uzbekistan.**—*C. R. Acad. Sci. URSS* (N.S.) **43** no. 1 pp. 32–35, 1 ref. Moscow, 1944.

In the course of work on *Eurygaster integriceps*, Put., in the mountains and foothills of the basin of the Kashka-Dar'ya, in south-western Uzbekistan [*cf.* *R.A.E.*, A **33** 159], a study was made of the wild food-plants of this Pentatomid. It was shown to be highly polyphagous. The preferred food-plants of the adults were mostly, and those of the nymphs exclusively, grasses, and among grasses, preference in feeding and oviposition was shown for the wild barleys, *Hordeum spontaneum*, *H. bulbosum* and *H. leporinum*. The view of other Russian workers was confirmed that *E. integriceps* is often commoner and oviposits more readily on many wild cereals than on cultivated ones. This preference depends on the state and stage of development of the plant, the bugs being most numerous on fresh, densely growing plants during the period from the formation of the ears to the stage of milky and waxy ripeness. Cultivated cereals were preferred, however, if they were in the same stage of development as the wild ones. Feeding and oviposition on composites were often observed, but less frequently, preference being shown for *Carduus pycnocephalus*.

By June, the favoured grasses became yellow and dry, and the bugs then passed on to *Agropyrum trichophorum*, which was still green. This couch-grass is common in the mountains from about 4,300 to 6,600 ft., where the permanent breeding grounds of the bug occur [*cf.* **32** 103], and because of the relatively slow growth and ripening of the ears and its resistance to drought, this plant is of great importance in the survival and maintenance of the bug population.

It is recommended that crops should be protected by the destruction of wild food-plants. The use of trap-crops of cultivated or wild cereals is unlikely to be successful when extensive grain fields are surrounded by preferred wild food-plants.

FEDOTOV (D. M.). **Relations between *Eurygaster integriceps* and Phasiid Flies parasitic on the Bug, and Phasiids as a Means for controlling it.**—*C. R. Acad. Sci. URSS* (N.S.) **43** no. 3 pp. 134–136, 5 refs. Moscow, 1944.

During investigations in 1941–42 on *Eurygaster integriceps*, Put., in the valley of the Kashka-Dar'ya, in south-western Uzbekistan [*cf.* *R.A.E.*, A **33** 159], it was observed to be parasitised by two Phasiine Tachinids, *Helomyia lateralis*, Mg., and *Alophora subcoleoptrata*, L. The former was already known as a parasite of this Pentatomid [*cf.* **1** 448; **30** 409], but the latter was not. Of 721 adult bugs dissected in 1942, 11·8 per cent., mostly females, contained larvae of these Tachinids. Most of the parasitised bugs contained one larva each, but some harboured two, three or even four. Of the parasitised bugs, 18 per cent. were taken feeding on crops or wild plants, and the rest were hibernating. Parasites were not found in bugs of the new generation on crops in June, and were present in only two of 48 that had entered aestivation. The external appearance of parasitised individuals was not distinguishable from that of healthy ones, but histological examination showed that the ovaries of the females were affected. The degeneration that took place is described. It is thought possible that the reproductive organs of the males are also affected.

In Central Asia, the resumption of activity by the overwintered bugs extends over a period of more than two months [*cf.* **33** 159] and the duration of development of the parasites varies correspondingly. In the field, the larvae left the overwintered bugs in spring and pupated in the soil, and the pupal stage lasted 9–16 days, depending on altitude and season. In the laboratory, the first flies emerged during the second half of March. Both *H. lateralis* and *A. subcoleoptrata* are widely distributed in the Kashka-Dar'ya region, mostly in the mountainous zone ; they visit the flowers of wild plants, especially *Ferula*, and also occur on various crops, on which they congregate during the active life of their hosts. Their presence in large numbers in areas in which *E. integriceps* is scarce indicates that they also parasitise bugs of other species.

Tachinids of this group are believed to have caused considerable mortality among hibernating examples of *E. integriceps* in the Krasnodar region of the North Caucasus, where 80–85 per cent. of the bugs were found to be parasitised by them, and the author considers that they may be useful for biological control. When the overwintered bugs are collected in spring, they should be kept alive in a box with a perforated bottom until all the parasite larvae have emerged from them. These and also any puparia that are formed should be placed in a shady place in the field and covered with a thin layer of soil. When large numbers of *E. integriceps* are collected in autumn and winter, the puparia should be kept in sand in boxes under natural conditions and transferred to the field on the approach of spring.

[KOLESNIK (I.).] **Колесник (И.). Using Hens for the Control of Pests of agricultural Crops.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **9** no. 4 pp. 3–11. Moscow, 1944.

Fowls were used on a large scale for the control of the weevil, *Cleonus punctiventris*, Germ., on sugar beet in the Ukraine for the first time in 1941, and figures are given for the whole region and for selected farms showing that they were very effective [*cf. R.A.E.*, A **30** 374]. In all, over 8 million fowls were allowed to run in the fields, and less than 1,250 acres had to be resown on account of infestation as compared with nearly 540,000 acres in 1940. It is shown that this great reduction in infestation was not due to natural causes, and the way in which the work is best organised on collective farms is outlined. In some cases, the use of fowls was supplemented by trap-ditches and trap-plots of beet [*cf.* **30** 578]. Fowls have also been used to control several other pests of field crops.

[ZHUKOVSKIĬ (A.) & OSTAPETZ (A.).] **Жуковский (А.) и Остапец (А.). Causes of Increases and Depressions in *Eurygaster integriceps* Put. Populations.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **9** no. 4 pp. 21–24. Moscow, 1944.

Eurygaster integriceps, Put., is the most important of the three species of its genus that attack cereals in European Russia [*cf. R.A.E.*, A **30** 409] and is the only one that assumes outbreak numbers therein. This Pentatomid is constantly injurious in a region comprising parts of Central Asia, Persia and Iraq, and observations have shown that outbreaks in Russia are shorter and less frequent as the distance from this region increases. The northernmost limit of *E. integriceps* in European Russia lies in the arid and semi-arid zone in the Provinces of Voronezh and Kursk, with vegetation characteristic of the southern steppe, a mean temperature of 20°C. [68°F.] in June and an annual rainfall not exceeding 16 ins. Factors leading to outbreaks are discussed, with special reference to Voronezh, where they are liable to occur following several years of severe drought, with mean monthly temperatures of not less than 16°C. [60·8°F.] in May, 21°C. [69·8°F.] in June, and 23°C. [73·4°F.] in July. Under these conditions, the overwintered adults resume activity earlier and feed over a longer period than usual, which increases the fecundity of the females ; development of the eggs and nymphs is accelerated, so that nymphs from eggs deposited late reach maturity, and mortality of the nymphs is reduced because their development coincides with that of the cereals on which they feed. Furthermore, dry weather in autumn checks the incidence of fungous and bacterial diseases among the hibernating bugs.

The causes that led to the collapse of an outbreak in Voronezh in 1939–41 are discussed, and it is shown that the contributing factors included increased mortality of the nymphs in the autumn of 1940, following the peak of the outbreak, because oviposition was protracted over a period of 60 days and few of the nymphs from the late eggs reached maturity by harvest, insufficient accumulation of fat in over 40 per cent. of the overwintering bugs as a result of competition for food after harvest, which rendered them susceptible to fungous and bacterial diseases, abundant rain in autumn, which favoured these diseases, parasitism by *Phasia* sp., and local mortality due to frost or floods. As a result, only 50 per cent. or less of the initial hibernating population survived the winter, and the use of fowls in spring in the forests where the bugs occurred further reduced their numbers [*cf.* **30** 374]. The resumption of activity and oviposition in 1941 were delayed by cold weather in May and June, and the cereal crops meanwhile became too advanced to provide suitable nourishment, as a result of which up to 38 per cent. of the females did not oviposit and the others laid few eggs. Nymphal development was protracted, and the percentage that reached the adult stage by harvest was considerably reduced. Consequently, the number of bugs that entered hibernation in 1941 was no greater than normal.

[STAROSTIN (S.).] **Старостин (С.). Control of** *Eurygaster integriceps* **Put. by Aircraft.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **9** no. 4 pp. 25–27. Moscow, 1944.

Eurygaster integriceps, Put., causes severe losses to grain crops in Uzbekistan, and though fowls proved of great value against it [*cf. R.A.E.*, A **30** 374], they were not available in sufficient numbers for use on a large scale. Experiments were therefore carried out in 1942 in the Provinces of Samarkand, Tashkent and Kashka-Dar'ya in which calcium arsenite was applied as a dust from an aeroplane at the rate of 4½ lb. per acre. The resulting mortality was 43·1, 65·2–91·8 and 65–100 per cent. in the three Provinces, respectively, and the method was much more effective than hand collection.

Experiments on two farms in Kashka-Dar'ya are described. In one, fields of growing wheat, some of which was already in ear, were dusted from an aeroplane on 4th or 5th May with calcium arsenite at rates of 2·7, 4·5 and 9 lb. per acre, and counts of adult bugs made at intervals for 12 days. At the end of this period, the number of live bugs had been reduced by 60·8, 71·3–76·5 and 89·2 per cent., respectively, as compared with 20·8 per cent. in the control, and 40·8, 62·9–63·8 and 85·7 per cent. of the bugs found were dead, as compared with 8 per cent. in the control. Dusting was more effective in the presence of dew, and also gave high mortalities of the larvae of the Criocerid, *Lema melanopa*, L. No scorching of the plants was observed. Spraying from aircraft was tested on the other farm on 20th May, when the nymphs were migrating to the ears, which were near the end of the flowering stage. The insecticides used were a 2 per cent. solution of sodium arsenite and a 15 per cent. solution of sodium nitrite, and both were applied at the rate of about 9 gals. per acre, which is only one-tenth of the rate commonly used in ground spraying. There was no dew, the spray was distributed evenly over the treated areas. The percentage mortalities of adults and nymphs estimated a week later and based on the numbers originally present were 75 and 80·5 for sodium arsenite, and 62 and 64·7 for sodium nitrate, as compared with 78·9 and 34·6, respectively, for a dust of calcium arsenite at 4·5 lb. per acre ; in the control, 33 per cent. of the adults died, but the nymphs increased in numbers. At half the rate, both sprays gave poor mortality. Some scorching was caused by the sprays, probably owing to the high temperature, which reached 38°C. [100·4°F.] in the shade, but the plants completely recovered in a week. On the whole, conditions were not favourable for either spraying or dusting, as there was no dew and heavy rain washed the poison off the plants three days after the treatment.

In 1943, 225 sq. miles in Uzbekistan and 9 sq. miles in Kirghizia were dusted from aircraft with calcium arsenite at the rate of 4·5 or 3·6 lb. per acre. The results were satisfactory in most cases, and the damage was much less than in the three preceding years. It is recommended that grain should be dusted on dewy mornings, before dry weather sets in, and before the ears appear; the treatment should be completed at least 15 days before harvest.

[GERASIMOV (V.) & OSNITZKAYA (E.).] **Герасимов (В.) и Осницкая (Е.). Creolin in the Control of Pests and Diseases of Vegetable Crops.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **9** no. 4 pp. 46–48. Moscow, 1944.

The results are given of experiments carried out in and near Moscow in 1942 and 1943 on the value as an agricultural insecticide and fungicide of a coal tar distillate known as creolin, which boils at about 220°C. and is stated to contain 27·7 per cent. phenols, 67·5 per cent. neutral oils, 2·9 per cent. carbolic acids and 2·6 per cent. pyridin bases. Soap or sulphite lye was used as the emulsifier for the sprays, and ash or clay as the base for the dusts.

In preliminary laboratory work, 1–2 per cent. emulsions killed 92–100 per cent. of the eggs of the onion fly [*Hylemyia antiqua*, Mg.], and the 1 per cent. emulsion was very effective against the eggs of the cabbage fly [*H. brassicae*, Bch.], but concentrations of 5–10 per cent. were required for high mortality of the larvae of either species. The development of cabbage plants was not affected by watering with a 1 per cent. emulsion of creolin prepared with soap, and onions withstood concentrations of up to 3·5 per cent. In some instances cabbage seedlings were injured at the root-collar by watering with an emulsion containing 2 per cent. creolin and 2 per cent. soap, and cabbage leaves accidentally wetted with one containing 1 per cent. creolin and 0·33 per cent. soap showed signs of scorching.

In field experiments carried out during the oviposition period of the first generation adults of *H. antiqua*, in which two applications were made, the percentages of infested plants and (in brackets) of infested bulbs at harvest were 24·3 (20) for a 1 per cent. emulsion and 28·7 (33) for a 5 per cent. dust of peat ash impregnated with creolin, as compared with 52·3 (43) in the control. In further tests, creolin was effective against *H. brassicae*, and treating plant remains or the wooden parts of greenhouses with 1·5 and 2 per cent. emulsions killed 96·2 and 100 per cent., respectively, of the red mite [*Tetranychus*].

In other preliminary tests, a 5 per cent. creolin dust protected sprouting crucifers from attack by flea-beetles better than ash alone, though not so well as nicotine dust, and a similar dust caused a high mortality of the larvae of the cabbage moth [*Mamestra brassicae*, L.] in the laboratory.

[SEREBROVSKIĬ (A. S.), TUPIKOV (V.) & KHVOSTOVA (V. B.).] **Серебровский (А. С.), Тупиков (В.) и Хвостова (В. Б.).** *Ernestia consobrina* **Meig., a Parasite of the Larvae of Noctuids that attack Vegetables, and Measures furthering its Activity.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **9** no. 5–6 pp. 16–19, 3 refs. Moscow, 1944.

The Tachinid, *Ernestia consobrina*, Mg., which is an important parasite of Noctuid larvae in Russia, was common on vegetable plots near Moscow in July and August 1943, its chief host being *Mamestra* (*Barathra*) *brassicae*, L. Its characters and distribution are briefly described, and an account is given of observations on its bionomics, supplemented by information from the literature [*R.A.E.*, A **16** 367; **25** 606]. There is only one generation a year in Moscow. The adult flies emerged at the end of June in the field, the males up to a fortnight before the females, and fed on the nectar of various plants, particularly parsnip, carrot, fennel and cummin. The females were fertilised 1–2 days after emergence and deposited their larvae on infested leaves. The larvae left their hosts after 23–24 days in the laboratory and pupated in the soil, usually at depths of 2–3 ins. The first puparia were observed on 31st July, and the last adults on 31st August. Larvae of *M. brassicae* of all sizes were attacked, but the percentage that died before the parasites became full-fed was very high among small individuals, decreasing as the size of the host attacked increased.

In the laboratory, larvae of *E. consobrina* also attacked those of *Musca domestica*, L., and *Galleria mellonella*, L., but the latter proved unsuitable as hosts and the only two puparia reared were under-sized. Larvae of *Pieris brassicae*, L., and *P. rapae*, L., were rarely attacked, possibly because of the hairs with which they are covered, since even larvae of *M. brassicae* on the leaves of turnip and potato, which are hairy, were not found parasitised in the field.

Investigations in different plots in 1943 showed that the percentage parasitism of *M. brassicae* ranged from 42·5 to 62·3 in August and 26 to 50 in September, after the end of the flight period, but these figures do not include small individuals that died before the parasites were able to develop. Since up to 75 per cent. of larvae 15–22 mm. long died in this way, it is calculated that an apparent percentage parasitism of 60 represents an actual percentage of 90. The percentage parasitism became less as the distance from suitable sources of nectar for the adult flies increased. Measures to increase parasitism in a plot comprise the establishment of such plants and of small plots containing a few suitable food-plants to which parasitised larvae can be transferred, so that the parasite puparia are not disturbed by cultivation.

[Ponomarenko (D.).] **Пономаренко (Д.). Simple Pest Control Measures on Seed Alfalfa.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **9** no. 5–6 pp. 20–23. Moscow, 1944.

Severe losses in the yield of lucerne seed in the region of the Lower Volga have recently been caused by various insect pests, and in view of the shortage, owing to war conditions, of insecticides and labour and equipment for applying them, simple agricultural measures of control that could easily be carried out on any farm are suggested, and instances are given of their successful use.

The best way to keep young lucerne grown for seed free from the main pest [*cf. R.A.E.*, A **30** 135] is to plant it at a distance of not less than 500 yards from old fields of lucerne, preferably in low-lying floodland and close to fields of cereals, and to allow a seed crop to develop in the first year. This will prevent, or greatly reduce, infestation by weevils of the genus *Sitona*, which attack the sprouting plants, the Cecidomyiids, *Dasyneura ignorata*, Wachtl, and *Contarinia* spp., and the weevil, *Hypera transsylvanica*, Petri, all of which damage the flower buds, the Capsid, *Adelphocoris lineolatus*, Goeze, which feeds on the inflorescences, and the Eurytomid, *Bruchophagus gibbus*, Boh., weevils of the genus *Tychius*, and the Tortricid, *Cydia microgrammana*, Gn., all of which attack the seed pods.

To secure a good crop of seed from old non-irrigated lucerne, it should be mown for hay in the year preceding that in which it is to be grown for seed. Fields should be selected that are not densely sown, are free from the Cerambycid, *Plagionotus floralis*, Pall., and are situated in low-lying places; the lucerne should be mown repeatedly during the season when flowering begins, and in the following year it should be mown once and then allowed to set seed. The hay should be cut at a height of about 2 ins. from the surface of the soil and should be immediately removed from the field. In the case of irrigated old lucerne, a normal yield of seed should be obtained if the crop is mown once for hay at the beginning of flowering and then allowed to set seed, provided that the fields are at a considerable distance from lucerne grown for seed earlier in the season. In this way, the plants escape mass injury by *H. transsylvanica*, the Cecidomyiids and *A. lineolatus*.

[STARK (V.).] **Старк (В.). Causes of poor Effectiveness of *Trichogramma* in the experimental Control of Pests.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **9** no. 5–6 pp. 26–27. Moscow, 1944.

The author considers that the disappointing results that have in some cases followed the liberation of predators and parasites of insect pests in the Russian Union, especially that of *Trichogramma* spp., may be due largely to the adoption of breeding methods involving constant conditions of temperature and humidity. This leads, in the case of *Trichogramma*, to the production of populations with reduced ecological adaptability, and it has been observed that the bulk of the parasites produced in this way congregate after release in parts of the infested area in which conditions resemble those under which breeding took place. Their ecological adaptability is invariably less than that of the host, and their effectiveness is reduced in proportion. In experiments in 1938–40, populations of *Trichogramma* bred at constant temperatures and humidities and liberated did not penetrate into parts of the experimental plots in which the relative humidity was below 65 per cent. and did not attack eggs in exposed situations, whereas individuals from stocks reared for generations under changing conditions dispersed over a larger area and behaved as did those taken in the field and released.

In experiments in the region of Voronezh, *Trichogramma* was released at the rate of 40,000 per acre against *Agrotis* (*Euxoa*) *segetum*, Schiff., in two fallow fields in which 17 and 29 per cent. of the soil surface was covered with vegetation. The resulting percentages of parasitism of the eggs averaged 46·9 and 62·6, respectively, for parasites bred under constant conditions, 77·2 and 86·8 for those bred under varying conditions and 84·4 and 89·6 for those taken in nature and liberated.

On the basis of these observations, the author considers that by rearing parasites or predators at changing temperatures, humidities and light intensity, with fluctuations greater than in nature, it might be possible to obtain populations adapted to an even greater range of conditions than the hosts against which they are to be liberated.

[STAROSTIN (S.).] **Старостин (С.). Air-spraying for the Control of Cotton Pests.** [*In Russian.*]—*Proc. Lenin Acad. agric. Sci. U.S.S.R.* **9** no. 5–6 pp. 36–40. Moscow, 1944.

An account is given of experiments in 1941 and 1942 to test the effectiveness of applying sprays from aircraft to cotton fields infested by the cotton Noctuid [*Heliothis armigera*, Hb.] and the cotton Aphid [*Aphis gossypii*, Glov.] in the region of Krasnodar (North Caucasus) and *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.) in Azerbaijan. In the case of *H. armigera*, suspensions of calcium arsenate at rates of 2·7, 4·5 and 6·3 lb. in 5·4 gals. water per acre were compared with a dust of calcium arsenate at 9 lb. per acre, all applied from an aeroplane flying across the rows at times when there was little dew and at a height of about 16 ft. The sprays were prepared on the day before they were used, and the spray tank was provided with a special agitator. Subsequent observations showed that the residues adhering to the leaves on the day of application and 5 days later were greater for all the sprays than for the dust on the upper part of the plants and greater for all but the weakest spray on the lower part, and the percentages that adhered after 5 days were greater in every case for the sprays. Figures showing the results of the treatments on *H. armigera* are not given, but it is stated that the weakest spray was almost as effective as the dust and more economical.

In similar tests against *A. gossypii*, sprays of 2·5 or 1·25 per cent. anabasine-sulphate and 2·5 per cent. soap applied at about 9 gals. per acre were compared with a dust of anabasine sulphate at about 31·5 lb. per acre. This dust was prepared by sprinkling 33 parts road dust with 2·5 parts 40 per cent. anabasine-sulphate as a 7·5 per cent. solution. The percentage mortalities of the Aphid given by the three treatments after 48 hours were 100, 74·3 and 13, respectively. Thrips were also killed, but larvae of *H. armigera* were not affected. Both sides of the leaves were wetted by the sprays, since the air currents produced by flying at such a low level apparently turned the leaves. The percentage mortalities in the controls were 9·7 in the case of the sprays and 3·1 in that of the dust.

In the experiments against *T. telarius*, a 10 per cent. suspension of sulphur containing 3 per cent. soap and a 4 per cent. solution of anhydrous sodium carbonate (soda ash) and 4 per cent. soap, both at the rate of about 9 gals. per acre, gave 77·2 and 68·7 per cent. mortality in six days, respectively, as compared with 62·9 per cent. given by a dust of sulphur alone at the rate of 27 lb. per acre. The tests were carried out late in the season, however, and the plants were only lightly infested, so that these results are not regarded as conclusive.

EDELSTEN (H. M.). **Contribution to the Life-history of *Oria musculosa* Hübn. (Lep. Noctuidae).**—*Entomologist* **77** no. 977 pp. 145–148, 1 pl. London, 1944.

Adults of *Oria musculosa*, Hb., the immature stages of which are described, were common in wheat fields near Salisbury in 1940, and since this Noctuid sometimes causes losses on the continent of Europe, observations on its frequency were made at intervals in 1941–43. The moths were present on wheat in 1941 and on wheat and oats in 1942. Some taken in August 1942 oviposited in the lower sheathing leaves of wheat stems in the laboratory, the eggs, which were kept out of doors, began to hatch on 2nd April 1943, though others kept elsewhere hatched on 10th March. When the larvae were placed on young plants of autumn wheat in pans, they made their way down the central shoot or bored into it at the base and fed for a fortnight, when the shoot turned yellow. They then entered the tillers, each one attacking several in turn. When these were destroyed, the main stems were too hard for the larvae to enter, but some survived when transferred to spring oats. Pupation occurs in the soil.

In May 1943, heavy infestations were observed in fields of spring oats and barley that had been under cereals in the previous year, and stems damaged by the larvae were readily distinguishable from those attacked by the frit fly [*Oscinella frit*, L.] since the second leaf, as well as the central shoot, was withered. The distribution of the larvae indicated that the eggs had been deposited on the crops and not on grasses bordering the fields, as they sometimes are in Russia [*cf. R.A.E.*, A **25** 270]. Evidence was obtained that the eggs survive threshing and give rise to larvae that migrate from straw stacks to neighbouring grain crops, and they are not destroyed when the stubble is ploughed in. In a field of autumn-sown oats in which infestation was not apparent, examination showed that many young shoots contained dead larvae that had presumably been killed by a bacterial disease. By 18th June, the larvae had reached the last instar and were feeding within the ear sheaths. The only external evidence of their presence at this stage was the small entry hole below the ear, but by early July, when the larvae had left the plants, the sheaths of infested ears had withered. Although the larvae had been abundant, the adults were scarce in August, either because they had emerged early or as a result of the disease of the larvae. The increase in numbers of this Noctuid in recent years is attributed to the abandonment of crop rotation during the war period and the practice of placing stacks along the edges of fields that are to be under cereals in the following year. One larva was found to be parasitised by the Ichneumonid, *Meloboris crassicornis*, Grav.

BARNES (H. F.). **Investigations on the Raspberry Cane Midge, 1943–44.**—*J. R. hort. Soc.* **69** pt. 12 pp. 370–375, 4 refs. London, 1944.

The results are given of investigations in southern England on the bionomics of the Cecidomyiid, *Thomasiniana theobaldi*, Barnes, a serious outbreak of which occurred on raspberries at Wisley in 1943 [*cf.* *R.A.E.*, A **32** 258–259]. In tests in which newly-emerged adults were caged with isolated raspberry plants, some of which were free from blemishes on the stem while others had been artificially scarred, no eggs were laid except where the skin was broken, and it is concluded that under the conditions of the experiment, the females preferred to deposit their eggs in such positions. To determine whether only parasitised larvae remain on the stems during the winter, infested canes collected in July and September were placed for a time in breeding cages containing fibre and then removed to fresh cages. Counts of the adults that emerged from the fibre and from the canes showed that with few exceptions the parasitised larvae remained on the stems, whereas all but one of the healthy ones descended into the fibre for the winter. This indicates that cutting out and burning infested canes without due regard to the state of development of the insect may result merely in the destruction of its parasites.

When the midge was offered various specially prepared isolated plants for oviposition, eggs were deposited in all cases on raspberry, wild and cultivated blackberry, loganberry, apple and quince, in many cases on rose, and sometimes on hawthorn [*Crataegus*] and plum, but not on cherry, currants, gooseberry or Worcesterberry, and the only plants on which development was completed were raspberry, blackberry and loganberry, except that on one occasion two small individuals completed their life-cycle on rose. The progeny of any one female were all or predominantly of one sex. There was little difference in the length of the life-cycle on the different plants ; that of the overwintering generation in 1943–44 was 276–278 days, and those of the first and second generations in 1944 were 47–60 and 38–39 days. Adults of the three generations were present from 9th May to 3rd June, 14th July to 8th August and 25th August to 17th September. There is also possibly a fourth emergence of adults, since larvae collected in August gave rise to adults between 17th September and 8th October.

Other Cecidomyiids reared from canes infested by *T. theobaldi* were a species of *Lestodiplosis*, the larvae of which are probably predacious on those of the former, and one of the genus *Clinodiplosis*, which was observed only in the laboratory and is probably of no importance. The exact relationships between *T. theobaldi*, *T. oculiperda*, Rübs., *T. crataegi*, Barnes, [*cf.* **27** 673] and an unidentified species of the same genus stated to have been reared from *Ribes alpinum* in the Ruhr in 1938–39 are not known, but the author considers that they should provisionally be regarded as distinct, both on account of the results obtained in the rearing experiments and because serious outbreaks of more than one species have not yet been recorded in the same season or in the same locality.

Baeta Neves (C. M.). **Primeiros resultados do estudo feito sôbre um meio de luta contra a** *Lymantria dispar* **L.** [The preliminary Results of a Study of a Method of controlling *L. dispar*.]—*Bol. Junta nac. Cortiça* no. 46 pp. 5–10, 4 figs. Lisbon, 1942. (With a Summary in English p. ii.) [Recd. 1945.]

Lymantria dispar, L., was recorded on cork oak [*Quercus ilex* var. *suber*] in Portugal for the first time in 1886 and has since spread considerably on this tree. An experiment was carried out in March 1942 on the effectiveness of scorching the egg-masses, which are present on the trees from August to the end of March, by means of a blow-lamp. The trees were first pruned, which removed 15 per cent. of the egg-masses, and an attempt was then made to scorch all those remaining on the trunks and branches. No conclusions are drawn from the work, and various practical difficulties that arose in the course of it are discussed.

Baeta Neves (C. M.). **Sôbre a distinção entre a** *Lymantria dispar* **L. e outras pragas que atacam o sobreiro. O caso do " burgo da azinheira " e o da " portésia."** [The Distinction between *L. dispar* and other Pests that attack Cork Oak. The Case of *Tortrix viridana* and *Nygmia phaeorrhoea*.]—*Bol. Junta nac. Cortiça* nos. 50–51 pp. 49–53, 97–101, 11 figs. Lisbon, 1942–43. (With Summaries in English pp. x, xvii.) [Recd. 1945.]

Cork oak [*Quercus ilex* var. *suber*] in a district in south-central Portugal is attacked by *Lymantria dispar*, L., *Tortrix viridana*, L., and *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*, auct.). A campaign is in progress for the control of *Lymantria*, which is the most important of these, and since *Tortrix* has sometimes been mistaken for it, the author describes all stages and the bionomics of the three moths, with special reference to features that enable them easily to be distinguished. *Lymantria* and *Tortrix* both overwinter in the egg on the trees, but the eggs of *Lymantria* are deposited in masses of about 400 covered over with matted hairs, while those of *Tortrix* are laid in groups of 2–3 and are difficult to detect. The larvae of *Lymantria* hatch at the end of March or the beginning of April, feed first on the new foliage and female inflorescences and then on the older leaves, completely defoliating the trees, and pupate in May, the adults emerging in July. Defoliated trees produce fresh leaves after about a month. The larvae of *Tortrix*, which are present at the same time as those of *Lymantria*, are solitary feeders, suspend themselves from threads and attack the old leaves, so that the trees are not completely defoliated. They also destroy the female flowers. The eggs of *Nygmia* are laid in masses, but these are smaller than in the case of *Lymantria*. The larvae hatch in August, feed until the end of September, overwinter in nests and resume feeding in April. They pupate in June, and the resulting adults oviposit in July. Feeding causes little injury in autumn, and though whole leaves are destroyed in spring, the trees are not defoliated.

Baeta Neves (C. M.). **A fisiologia do sobreiro e o ataque da** *Lymantria dispar* **L.** [The Physiology of the Cork Oak and Attack by *L. dispar*.]—*Bol. Junta nac. Cortiça* nos. 57–59 pp. 367–369, 415–419, 465–468, 4 figs., refs. Lisbon, 1943. (With a Summary in English pp. lxxxviii-lxxxix.) [Recd. 1945.]

The author describes the physiological functions of the leaves of a tree and discusses at some length the effects of defoliation by the larvae of *Lymantria dispar*, L., on cork oak [*Quercus ilex* var. *suber*] in Portugal. Repeated defoliation leads to a reduction in the quantity and quality of the bark, as well as affecting the formation of wood. This disturbance of growth is more injurious than that which follows pruning or the stripping of the bark, and it is recommended that bark should not be stripped from trees that have suffered defoliation.

BAETA NEVES (C. M.) & AZEVEDO E SILVA (F.). **Nota sôbre a aplicação da luta biológica na campanha da** *Lymantria.* [A Note on the Application of Biological Control in the Campaign against *Lymantria.*]—*Bol. Junta nac. Cortiça* no. 63 pp. 101–103, 14 refs. Lisbon, 1944. (With a Summary in English p. xxiii.)

In connection with the campaign against *Lymantria dispar*, L., on cork oak [*Quercus ilex* var. *suber*] in Portugal, the authors summarise the work that has been done on the biological control of this moth there and in other parts of the world. Of the 46 species of parasites and predators imported into the United States against it since 1905, 15 are known to have become established, but they have not proved so effective as to render other methods of control unnecessary [*cf. R.A.E.*, A **33** 238]. *Ooencyrtus* (*Schedius*) *kuvanae*, How., was imported into Spain from the United States against *Lymantria* in 1923, became established there [*cf.* **12** 146 ; **14** 372] and spread somewhat, and in 1924 it was introduced into Morocco, where the percentage parasitism by it was subsequently estimated at 20 [*cf.* **22** 196]. It was imported from Morocco into Portugal in 1932 and spread over a considerable area, but although its introduction was followed in some plantations by great reductions in infestation, it is considered that this was due partly to other measures and that the parasite is no more effective there than in Morocco. It is thought that large-scale liberations might prove more successful. Of the indigenous natural enemies of the moth, a list of which is given, the only ones that have been studied in Portugal are the predators, *Calosoma sycophanta*, L., and *Dermestes* sp. The former proved of little use, and the latter injured the bark.

GRIOT (M.) **Observaciones sôbre el pulgón verde de los cereales y su parásito** *Aphidius platensis* **en Santa Fe.** [Observations on *Toxoptera graminum* and its Parasite, *Aphidius platensis*, in Santa Fe.]—*Rev. argent. Agron.* **11** no. 4 pp. 309–319, 2 graphs, 6 refs. Buenos Aires, 1944.

Toxoptera graminum, Rond., which has been injurious to cereals in Argentina since 1937 [*cf. R.A.E.*, A **30** 277], causes severe losses to wheat and forage oats in the Province of Santa Fe [*cf.* **26** 289], and investigations on its bionomics and those of its parasite, *Aphidius platensis*, Brèth., were therefore carried out in 1941–42. The Aphid was bred on potted wheat plants at various temperatures, and the results are shown in tables and discussed. Most individuals moulted four times and completed their development in periods that ranged from 23·1 days at 9·5°C. [49·1°F.] to 5·4 days at 28·5°C. [83·3°F.], but some moulted up to eight times before reproducing and a few reproduced for a few days after the fourth moult and then moulted once or twice more. The period that elapsed between the fourth moult and the beginning of reproduction was irregularly correlated with temperature but in general ranged from 4 days or more at 12·5°C. [54·5°F.] and less to about a day at 21·5°C. [70·7°F.] or more. The greatest total numbers of offspring were obtained at temperatures of 12·5–20·5°C. [54·5–68·9°F.], the maximum average being 34·5 at 20·5°C. The duration of the reproductive period ranged from 46·9 days at 10·5°C. [50·9°F.] to 3 days at 29·5°C. [85·1°F.], and the numbers of young produced in a single day increased with temperature, the maximum observed being 11. Reproduction was irregular, however, in Aphids that produced more than five offspring on any single day. The total numbers of days for which the Aphids survived ranged from 61 at 11·5°C. [52·7°F.] to 10 at 30·5°C. [86·9°F.].

A. platensis is the most important parasite of *T. graminum* in Argentina, but is not specific [*cf.* **26** 290]. In the breeding experiments, males and females were introduced into cages containing wheat plants infested with Aphids in the third instar and left for 24 hours ; the cages were kept at various temperatures and observations were made daily for the emergence of parasites. Emergence in any one cage was distributed over 2–4 days, but the average periods required for complete development ranged from about 25 days at 13°C. [55·4°F.] to 15 days at 20°C. [68°F.] and 10 days at 23°C. [73·4°F.].

Attempts have been made to control the Aphid in Santa Fe by distributing parasitised individuals in the field, but the author considers that such releases are of doubtful value, since *A. platensis* is present throughout the Province, natural parasitism is quite high as soon as the Aphid appears in the fields in autumn, and the life-cycle of the parasite is longer than that of its host [*cf.* **26** 289]. Even if the parasite were released in very large numbers as soon as infestation is observed, it is uncertain whether it would give effective control. Infestation is usually light in wet seasons and has little effect on the plants, but heavy in dry years, in spite of a high percentage of parasitism, and the plants then suffer severely. It was observed in experimental plantings in 1938 that infestation began in May ; crops sown at the beginning of that month suffered considerably, but those sown a month earlier were only lightly infested. Cultural measures, such as deep ploughing, that tend to conserve soil moisture, increase the resistance of the plants to the effects of infestation.

DA FONSECA (J. P.). **O bicho mineiro das fôlhas do cafeeiro** *Leucoptera coffeella* **(Guérin-Méneville).** [The Coffee Leaf-miner, *L. coffeella.*]—*Biológico* **10** nos. 8–10 pp. 253–258, 298–303, 329–339, 1 pl., 3 figs., 51 refs. São Paulo, 1944.

In view of an outbreak of *Leucoptera coffeella*, Guér., that began on coffee in São Paulo in 1944, the author gives an account based on the literature of the serious outbreak that occurred in Brazil in 1860–62, describes all stages of this leaf-miner and the injury that it causes, and gives the results of laboratory studies on its life-history, which he compares with those recorded from other parts of the world. At 21°C. [69·8°F.], the egg, larval and pupal stages lasted 7–11, 27–42 and 16–22 days, respectively, and seven females deposited 5–10 eggs each. The Tineid is difficult to control, since the larvae are protected within their mines, and hand-collection of infested leaves is impracticable. Lists are given of the parasites that have been recorded from *L. coffeella* in various parts of the world [*cf. R.A.E.*, A **28** 549] ; they include eight from Brazil.

MONTE (O.). **Curculionídeos do algodoeiro.** [Weevils that attack Cotton.] —*Biológico* **10** no. 9 pp. 278–292, 1 pl., 7 figs., 15 refs. São Paulo, 1944.

Cotton is attacked in Brazil by the weevils, *Eutinobothrus* (*Gasterocercodes*) *brasiliensis*, Hambl., *Chalcodermus bondari*, Mshl., and *C. marshalli*, Bondar. *E. brasiliensis*, of which all stages are described, is the most important of the three, and is represented in part of its range (Pernambuco) by an unnamed variety [*cf. R.A.E.*, A **27** 136]. A detailed account is given, largely from the literature, of its bionomics and control [*cf.* **26** 502 ; **27** 136 ; **29** 623 ; **33** 202]. In the author's observations in Minas Gerais, in a locality where the temperature averaged 26°C. [78·8°F.], the egg, larval and pupal stages lasted 5–6, 30–45 and 5–15 days, respectively. There may be two generations a year. The parasites that have been recorded from this weevil are shown in a list ; none affords effective control. *C. bondari*, the bionomics and control of which are also reviewed from the literature [*cf.* **23** 92 ; **27** 413], may be a synonym of *C. niger*, Hust. [*cf.* **23** 92], which was described from Bolivia, but the name is retained provisionally for the species that infests cotton in Brazil. *C. marshalli*, which was described from cacao in Bahia [**19** 14], was recorded from cotton for the first time in 1941, when it was observed attacking plants in an experimental field at Torres de Tibagi. Its original description is quoted, and it is stated that in breeding experiments, the egg, larval and pupal stages averaged 4, 23 and 8·5 days, respectively. The measures of control recommended are the same as for *C. bondari*.

Entomology and Economic Zoology.—*Rep. P.R.* [*fed.*] *Exp. Sta. 1943* pp. 21–24. Washington, D.C., 1944.

The section on general investigations in Porto Rico, by H. K. Plank, includes the results of an experiment on the value of copper carbonate and lime in protecting stored maize against insect attack, designed to discover a cheaper and safer method than fumigation with carbon bisulphide and subsequent isolation of the grain. *Calandra* (*Sitophilus*) *oryzae*, L., was the most injurious insect present in the maize used; *Cathartus quadricollis*, Guér., was next in abundance and small numbers of *Dinoderus minutus*, F. [*cf. R.A.E.*, A **32** 344] were also recorded, although evidence of feeding by this Bostrychid did not exceed 4 per cent. in any sample. Larvae of *Corcyra cephalonica*, Staint., became abundant after several months, and *Plodia interpunctella*, Hb., appeared later in grain that was already severely damaged by other insects. The percentages of grains infested in shelled maize mixed with hydrated lime alone and with a mixture of lime and copper carbonate were 62 and 72, respectively, three months after harvest, but in ears rolled in the mixture immediately after harvest or in lime when the grains had separated sufficiently to allow penetration to the base, they did not exceed about 15 during the first month and remained below 50 for three; the viability of the grain remained high during this period. Fumigation with carbon bisulphide prevented serious damage for over three months, but treatment of the ears with hydrated lime is recommended as a simple and cheap method of protecting the grain for at least three months.

In continued tests of the resistance of imported bamboos to *Dinoderus minutus* [*cf.* **32** 345], the figures for susceptibility to attack of *Bambusa textilis*, *Sinocalamus oldhami*, *B. longispiculata*, and *Dendrocalamus membranaceus*, compared with that of *B. vulgaris*, were 0·27 (the lowest yet recorded), 1·52, 6·23 and 8·99 per cent., respectively. *B. vulgaris vittata* showed high susceptibility (44·18 per cent.). Attack was again most frequent in internodes at the bottom and middle of the stem, and investigations showed that starch was most abundant at these levels; starch appeared to be present in very few sections of *B. textilis* and *S. oldhami*, and, although the wood of both was relatively soft, the culms were attacked less than those of the other species.

In the section on biological control, K. A. Bartlett states that 7,889 puparia of *Theresia claripalpis*, Wulp (*Paratheresia diatraeae*, Brèth.), which parasitises *Diatraea saccharalis*, F., on sugar-cane, were received from Brazil, but owing to mortality caused by a delay in transit, only 3,398 adults emerged; liberations of some of these and of stock reared in the laboratory were made in two localities. Other parasites of *D. saccharalis* received from Brazil were *Metagonistylum minense*, Tns., and *Ipobracon amabilis*, Brèth., and 173 adults of the former and 11 of the latter were liberated. Nine shipments of *Acaulona peruviana*, Tns., and *Hyalomyia chilensis*, Macq., which parasitise cotton stainers (*Dysdercus*) were received from Peru. Adults of the former oviposited in the laboratory in nymphs and adults of *D. sanguinarius*, Stål (*neglectus*, Uhl.) [*cf.* **32** 343], which were then liberated, and also in *D. andreae*, L. Adults of both parasites were also released.

A consignment of the Coccinellids, *Chilocoris cacti*, L., *Cladis nitidula*, F., and *Egius platycephalus*, Muls., which are predacious on Coccids and have recently become established in Porto Rico [*cf.* **32** 342], was shipped to the Panama Canal Zone ; *E. platycephalus* and *C. cacti* were shipped to Trinidad, and *Bufo marinus* to Florida.

Fennah (R. G.). **Food-crop Pests Investigation Windward and Leeward Islands. Some simple Methods of controlling Insect Pests of local Food-crops.**—20 pp., 1 pl. Port-of-Spain, Trinidad, Comptr. Developm. Welf. W.I., 1944.

This circular consists of extracts from a report already noticed [*R.A.E.*, A **32** 22], and deals with the control of insect pests of food crops in the Lesser Antilles and Trinidad by means of cultural measures and insecticides.

Wadley (F. M.) & Wolfenbarger (D. O.). **Regression of Insect Density on Distance from Center of Dispersion as shown by a Study of the smaller European Elm Bark Beetle.**—*J. agric. Res.* **69** no. 7 pp. 299–308, 2 figs., 15 refs. Washington, D.C., 1944.

The following is substantially the authors' summary. Following a consideration of the factors that may govern curves of insect dispersion, two pronounced infestations of *Scolytus multistriatus*, Marsh., on elm in New Jersey and Connecticut were studied in 1938 and 1939, respectively, with feeding by the adults at twig crotches as a measure of insect density. In neither infestation could indications of directional influence be found [*cf. R.A.E.*, A **32** 48], but in each case pronounced falling off in density with increasing distance from the centre was noted, the downward slope of the plotted curve tending to level off as the distance increased. At 401–800 ft. from the centre a low level of population was reached, and decline was hardly detectable further out except for a few individual trees. The high level of general activity round the centre extended only a few hundred feet. Indications were that individual beetles might travel more than a mile. In the range from the centre to the zone where levelling off was marked, the decline showed in each place an undoubted curvilinear regression, although with variable material and moderate numbers its advantage over linear regression was not pronounced. Best results in fitting were given by the curve of the equation $Y = a + b \log X + c/X$, in which X is distance and Y the percentage of crotches attacked.

Brown (R. C.). **The Spruce Budworm.**—*Leafl. U.S. Dep. Agric.* no. 242, 4 pp., 1 col. pl. Washington, D.C., 1944.

In view of the possibility that the present serious outbreak of *Harmologa (Archips) fumiferana*, Clem., in Canada [*cf. R.A.E.*, A **33** 143] may spread to the forests of spruce and balsam fir [*Abies balsamea*] in New England, New York and the Lake States, and that some undetected outbreaks may already occur in the United States, it is considered desirable that these regions and also forests of jack pine [*Pinus banksiana*] in the States bordering on Ontario and Quebec should be thoroughly surveyed. The author therefore describes all stages of this Tortricid and the nature of the injury that it causes [*cf.* **29** 507 ; **32** 427] and gives a brief account of its bionomics on spruce and balsam fir. The moths emerge and oviposit in late June and early July in the north-eastern United States and in late July in the Lake States ; the larvae hatch in 8–12 days and crawl about, apparently without feeding, until they find a suitable place under bark scales on the twigs or trunks to spin their hibernacula. They resume activity in spring when the buds are swelling, and first tunnel into the old needles and then enter the opening buds to feed on the new ones, later webbing the tips of the twigs together and feeding within the resulting nests. They pupate on the tree in June, the pupal stage lasting some 7–10 days.

Notes are given on the history, distribution and food-plants of *H. fumiferana*. In addition to the forms that infest balsam fir in the north-eastern United States, the Lake States and eastern Canada and Douglas fir [*Pseudotsuga taxifolia*] and alpine fir [*Abies lasiocarpa*] in Colorado and the north-western United States, one biological race in the Lake States and part of Ontario prefers jack pine and Scots pine [*Pinus sylvestris*], another in Colorado defoliates ponderosa pine [*P. ponderosa*], and a strain in Montana has been recorded from lodgepole pine [*P. contorta*]. Several other conifers are also attacked to varying degrees. The natural agencies that check the multiplication of *H. fumiferana* between outbreaks and its control by forest management are very briefly discussed [*cf.* **29** 507–508].

ROMNEY (V. E.). **The Effect of physical Factors upon Catch of the Beet Leafhopper (*Eutettix tenellus* (Bak.)) by a Cylinder and two Sweep-net Methods.**—*Ecology* **26** no. 2 pp. 135–147, 4 figs., 7 refs. Lancaster, Pa., 1945.

A detailed account is given of investigations in New Mexico in 1929–31 in which the numbers of *Eutettix tenellus*, Bak., on *Lepidium alyssoides* taken by means of a special sampling cylinder were compared with those taken in sweep nets used in two different ways in order to estimate the effect of physical factors on the size of catches made by sweeping [*cf. R.A.E.*, A **20** 362]. Catches were found to increase with temperature and to be decreased by wind, but other factors were of minor importance.

CHILDERS (N. F.). **Arsenical Spray Injury to Peaches.**—*Trans. Ill. hort. Soc. 1943* **77** pp. 460–465. Quincy, Ill., 1944.

Sprays of acid lead arsenate are commonly applied in the eastern United States against curculio [*Conotrachelus nenuphar*, Hbst.] on peach, but during the summers of 1942 and 1943, when wet periods were followed by high temperatures, they caused severe scorching, despite the inclusion in them of zinc sulphate [*R.A.E.*, A **32** 174]. Basic lead arsenate, which is used against the weevil in some of the eastern States and in California, causes very little scorching, owing to its low content of soluble arsenic, but is less effective against *C. nenuphar*. It is generally applied at twice the concentration required for acid lead arsenate.

Experiments with both forms of lead arsenate were carried out on five varieties of peach in Ohio in 1942 and 1943. Acid lead arsenate was used at a concentration of 2 lb. per 100 U.S. gals., with 1 lb. zinc sulphate and 3 lb. hydrated lime, and basic lead arsenate at 4 lb. per 100 U.S. gals., with 6 lb. hydrated lime ; both were applied at sepal-fall. Spray injury on the trees treated with acid lead arsenate was severe ; it comprised considerable scorching of the leaves, fruit and wood, which appeared about the end of July following a hot, wet period, some leaf-fall, and the development of cankers at the base of the petioles and on the younger wood ; the size, colour and quality of the fruit was poor. In both seasons, only occasional branches showed injury on the trees sprayed with basic lead arsenate. Varietal differences in the susceptibility of the fruits to injury were marked, those with the most pubescence being the most damaged. The variety Elberta, which is largely grown for commercial purposes in Ohio, was the least susceptible. Correspondence is quoted showing the results of investigations with basic lead arsenate in other States. It is widely used in parts of Pennsylvania, and causes little scorching, but is not of much value in Michigan, where many orchards contain both peach and apple, since it is ineffective against the codling moth [*Cydia pomonella*, L.]. It is recommended in California, since climatic conditions there usually favour injury when acid lead arsenate is used. In an experiment by Daines & Blake in New Jersey, acid lead arsenate caused the development of, on the average, one canker to every 2·4 inches of twig when applied at 400 lb. pressure from a distance of 4 ft. and to every 6·2 ins. when applied from a distance of 8 ft. ; the corresponding figures were 68 and 78·6 when lime was included in the spray, and about 739·5 for basic lead arsenate from both distances.

ARMSTRONG (W. D.) & RITCHER (P. O.). **Control of Curculio in Kentucky.**—*Trans. Ill. hort. Soc. 1943* **77** pp. 466–472. Quincy, Ill., 1944.

The plum curculio [*Conotrachelus nenuphar*, Hbst.], which is a major pest of peach and plum in Kentucky, generally has only one generation a year, but produces two occasionally under favourable conditions, such as occurred in 1941, and studies on its seasonal history and control were accordingly made in 1942–43. An account is given of the population trends in both years studied by jarring adults from peach trees in spring, rearing larvae in fallen fruits in emergence cages by a method that is described, and dissecting females obtained in this way and by jarring in late June and early July to determine the progress of egg development. Satisfactory results were obtained by jarring at any hour of the day or at night [*cf. R.A.E.*, A **20** 292]. In both years, a fairly large second generation occurred in western Kentucky, and in 1943 a light second generation was produced in districts towards the north of the State. In 1943, mature eggs were found in one first-generation female 16 days after emergence, and 50 per cent. of the females collected contained mature eggs by 6th July. A late spray was therefore recommended, and where it was applied control was in general good, though a fixed nicotine spray that was used instead of an arsenical in one orchard was ineffective. Observations in another orchard in 1943 showed that both overwintered and first-generation adults of *C. nenuphar* were scarce on trees nearest a fence-row from which vegetation and débris were cleared and burned during the winter, whereas they were abundant on the other side of the orchard where clearing had not been done. The trees received four applications of an arsenical dust, made at night, and one arsenical spray during the season, and very few peaches were infested at harvest, whereas infestation was heavy in a similar orchard in which the dusts were applied by day and débris and weeds were not destroyed.

Since the adults appear to be scarce on peach in western Kentucky before petal-fall and are not numerous until the sepals have fallen, the common practice of spraying as soon as the first adult is seen, and again two or three times at weekly intervals, is not effective ; the leaves enlarge rapidly at this season, and the cover of spray deposit is not complete at the time when the latest weevils appear. The authors therefore recommend delaying the first application until the weevils are fairly abundant and about to oviposit ; a thorough application at that time, followed by a second after 10–14 days should give good control of the first generation. A third application can then be made a month before harvest, if needed to prevent infestation by a second generation, without risk of the severe injury that usually follows the use of more than three arsenical sprays during a season. From the information obtained on the seasonal history, it is recommended that if orchards are cultivated, this should be done between mid-May and mid-June in order to destroy the pupae, which are then in the soil.

CASPER (M.). **Controlling Codling Moth with fewer Sprays.**—*Trans. Ill. hort. Soc. 1943* **77** pp. 475–477. Quincy, Ill., 1944.

This is a discussion of the control measures adopted against the codling moth [*Cydia pomonella*, L.] in an apple orchard in southern Illinois in which only 0·3 per cent. of the fruit contained larvae and about 1·5 per cent. showed superficial injury at harvest in both 1942 and 1943, although infestation was heavy in other orchards within a few miles. The spray programme comprised a calyx spray of lead arsenate at 3 lb. per 100 U.S. gals. and four cover sprays, including top-off sprays [*cf. R.A.E.*, A **31** 463] in the last two, in which the lead arsenate was used at 4 lb.; 3 U.S. quarts summer oil was included in the last three cover sprays. Applications were made at the rate of 12 U.S. gals. per tree, with about 3 U.S. gals. more for the top-off sprays; the trees were 21 years old. The successful results are attributed to thoroughness in applying the sprays and especially to scrupulous attention to orchard hygiene, comprising scraping and banding the trees each year, removing all cracked and split branches, pruning the trees in such a manner as to facilitate spraying, burning all prunings, removing all fallen apples and débris from the ground beneath the trees, and removing waste fruit each night from the packing sheds, which were not screened.

CHANDLER (S. C.). **Can we control Cat-facing and Curculio in Illinois?**—*Trans. Ill. hort. Soc. 1943* **77** pp. 493–505, 4 figs. Quincy, Ill., 1944.

The percentage of peach fruits showing the injury known as cat-facing in Illinois increased from 7 in 1941 to 19·9 in 1943, and studies were made there in the latter year to confirm previous work on the insects involved [*cf. R.A.E.*, A **16** 680] and to investigate control measures. Collections of insects were made from trees in various orchards in spring and each week between flowering and harvest. *Lygus oblineatus*, Say, comprised 95 per cent. of all the Capsids collected, and of the thirteen Pentatomids, one was predacious, and *Euschistus servus*, Say, *E. tristigmus*, Say, *E. variolarius*, P. de B., and *Podisus maculiventrus*, Say, constituted 50, 30, 7 and 5 per cent. of the others. The numbers of Pentatomids, Capsids and curculios [*Conotrachelus nenuphar*, Hbst.] taken during April–July are shown on a graph. Capsids were present earlier than the other insects and were most abundant at the beginning of April, before the flowers were fully open. In previous work on control, the experiments were mostly carried out at petal-fall or later, but at this period in 1943, Capsids had become scarce and the other species had not yet increased. Pentatomids reached a peak towards the end of April, when the sepals were separating, and again a month later. Adults of *C. nenuphar* reached minor peaks of abundance at the end of April and towards the end of May, and a major one in July. Little is known of the relative importance of these insects in causing cat-facing, and the results of tests in three orchards in which insects were caged on fruits at various dates between petal-fall and sepal-fall were mostly negative, though fruit caged with 16 Pentatomids, of which 12 were *E. servus*, on 19th May, when all the sepals had fallen, developed cat-facing of an atypical dimpled type. In another orchard, typical, but light, damage developed on fruits on which *C. nenuphar* had fed between 28th April and 4th May. Feeding by the adult weevils also causes roughening of the skin and exudation of gum, making the fruit unmarketable, but this damage probably occurs at a later stage. Some evidence of a correlation between prevalence of cat-facing and of infestation by larvae of *C. nenuphar* was obtained. Five peach trees that were growing close to black locust trees [*Robinia pseudacacia*] and had shown cat-facing in 1942 were jarred ten times between 6th April and 30th July 1943; of the insects collected, 115 were *C. nenuphar*, but the only examples of Hemiptera capable of causing the injury were six Capsids and eight Pentatomids.

In experiments on control, a finely-divided sulphur, a dust mixture of nicotine and sulphur (3 : 97), and an oil-impregnated dust containing 10 per cent. lead arsenate gave little or no reduction in the percentage of injured fruit, but since all the trees, including the controls, received applications of the oil-impregnated dust after the sepals had separated, the extent to which it affords control after this date is unknown. The percentages of damaged fruits in parts of an orchard in which the ground cover of *Lespedeza* was and was not removed were 13 and 20·7, respectively.

Infestation by *C. nenuphar* has increased since 1941. An oil-impregnated dust applied at petal-fall gave no control in 1943, but it is suggested that one made rather earlier than the sepal-fall stage might be useful while infestation remains high [*cf.* **33** 315]. These dusts are less injurious than sprays of lead arsenate and have proved equally effective against *C. nenuphar* [**29** 197].

MAGIE (R. O.). **Disease and Insect Control on Hops.**—*Bull. N.Y. St. agric. Exp. Sta.* no. 708, 20 pp., 4 figs. Geneva, N.Y., 1944.

Since hops in many parts of the State of New York are subject to attack by the Aphid, *Phorodon humuli*, Schr., and by downy mildew and powdery mildew (caused by the fungi, *Pseudoperonospora humuli* and *Sphaerotheca humuli*, respectively), field experiments were carried out in Oneida County in 1937–44 to develop effective and economical methods of controlling these pests. *Phorodon humuli* injures the plants directly by feeding on the leaves and cones, but most damage is done by a sooty mould (*Cladosporium aphidis*) that develops on the honeydew deposited by the Aphids in the cones. *P. humuli* is present in all hop gardens during July, but usually causes no appreciable injury until late August, when conditions favour its rapid increase.

One application on 21st July 1938 of nicotine sulphate at 1 : 800 or 1 : 1,200 with 3 lb. potash fish oil soap per 100 U.S. gals. or in Bordeaux mixture (8 : 4 : 100) killed over 95 per cent. of the Aphids by 22nd July in four tests, but a dilution of 1 : 1,600 killed less than 85 per cent. Soap alone was ineffective. Sprays of nicotine sulphate and lime applied towards the end of July, just before the cones grew out, were more effective in preventing the growth of sooty mould than those applied in August, as the Aphids are more difficult to reach with the spray after they are covered by the cone scales. Nicotine sulphate was more effective as a spray than in a dust; dusts of nicotine sulphate and lime containing up to 4 per cent. nicotine gave a poorer kill than a spray of nicotine sulphate (1 : 800) and are not recommended.

Other insect pests of hops in New York include *Empoasca fabae*, Harr., which is usually extensively injurious only in the smaller gardens near fields of leguminous crops or weeds, *Hydroecia immanis*, Gn. [*cf. R.A.E.*, A **27** 593; **28** 430–431] and *Pyrausta nubilalis*, Hb. *Empoasca* migrates from surrounding fields to hops during late June and July, soon after growth begins, and causes yellowing of the leaves and stunting of the vines and cones. Spraying with nicotine sulphate gave 75 per cent. kill, but the populations regained their original size within 3–4 days. Three applications of Bordeaux mixture (6 : 4 : 100), however, largely prevented the injury to the leaves and resulted in 52 per cent. greater yield of green hops than was obtained from unsprayed plots in 1938. This strength of Bordeaux mixture and a spray of zinc sulphate and lime (8 : 6 : 100) were more effective in reducing the percentage of leaf injury than several other fungicides.

In certain years, Bordeaux mixture injured young hop leaves during cool weather in May and June, whereas sprays of zinc sulphate and lime did not; to determine whether the injury was reflected in the yields, these sprays (both at 6 : 4 : 100 with wettable sulphur 5 : 100) were applied to the same plots during three successive seasons (1941–43). Diseases and insects were not important in either of the plots, and there was no significant difference between yields over the three years.

A simplified spray programme including Bordeaux mixture to control downy mildew and leafhoppers, sulphur to control powdery mildew and nicotine sulphate to control the Aphid is suggested from the results obtained in these experiments, and methods of mixing and applying the sprays are described.

MELLIS (A.). **Handbook of Pest Control.**—9 × 6 ins., 554 pp., 139 figs., 41 pp. refs. [New York, N.Y.] McNair-Dorland Co., Inc., 1945. Price $6.

This book on the life-history and control of household pests is intended primarily for pest-control operators in the United States. It is based on recent investigations and is a serviceable work, the value of which is increased by the numerous references to the very extensive and classified bibliographies. The greater part deals with Arthropods that damage the structure or contents of houses and those that attack man or may be otherwise injurious to health. Particular attention is given to ants and termites, the sections on which occupy over a quarter of the space devoted to insects. There are two final chapters on chemical control and house fumigation.

Entomological Investigations.—*17th Rep. Coun. sci. industr. Res. Aust. 1942–43* pp. 15–20. Canberra, 1944.

Entomological Investigations.—*18th Rep. Coun. sci. industr. Res. Aust. 1943–44* pp. 14–20. Canberra, 1944.

The results of work on insect pests in Australia in 1942–43 and 1943–44 are given in these two reports. A method of storing wheat, similar to that developed in Western Australia [*R.A.E.*, A **32** 138], in which millions of bushels are stored in a single mound in a large shed, has been adopted in Victoria. Observations of one such mound in 1942–43 showed that the moisture content of the wheat, which was initially 9·8 per cent., remained almost unchanged over a period of nine months, except for seasonal fluctuations in the top few inches ; seasonal fluctuations in temperature occurred to a depth of at least 9 ft. Owing to the low moisture content, *Calandra oryzae*, L., and *C. granaria*, L., were relatively rare, but *Rhizopertha dominica*, F., increased rapidly on the northern slope and the apex of the mound, causing the temperature of the wheat to rise to about 103°F. at a depth of 1 ft. and to increase appreciably at a depth of 9 ft. *R. dominica* was most numerous in heavily infested pockets within a foot of the surface and did not occur at depths exceeding 2½ ft. *Oryzaephilus* (*Silvanus*) *surinamensis*, L., and *Tribolium castaneum*, Hbst., were the principal secondary pests of bulk wheat in Victoria ; *T. confusum*, Duv., was rare. In experiments on control, sprinkling the surface of the wheat with 12 fl. oz. carbon bisulphide per sq. yd. and then covering it with a tarpaulin for 24 hours gave 95 per cent. mortality of adults. In 1943–44, it was found that further infestations could be prevented by treating the surface with an inert dust (magnesite or dolomite) and existing ones destroyed by local fumigation. The dust is applied by raking it in at the rate of 21 oz. per sq. yd. and scattering a further 14 oz. per sq. yd. over the surface ; this rate is equivalent to one of five tons per million bushels wheat. Dolomite was ineffective against *Rhizopertha* at rates of 7 and 21 oz. per sq. yd., but resulted in a lower level of infestation, as compared with the controls, and a greater percentage mortality of the adults at 43, 57 and 84·3. Carbon bisulphide at a rate of 16 fl. oz. per sq. yd. was the fumigant usually employed, the surface being covered with paper impregnated with bitumen after its application, but a mixture of ethylene dichloride and trichlorethylene (3 : 1) at the rate of 40 fl. oz. per sq. yd. was equally effective. The temperature of wheat fumigated in the early stages of infestation rapidly falls to normal levels, but if fumigation is delayed, it remains high, and the wheat may become reinfested. It was intended to fumigate the whole surface of the wheat several times a year to destroy isolated insects, but this was not done, as carbon bisulphide gave only low mortality of *Rhizopertha* in cool, lightly infested wheat. Wheat that was protected by dusting followed by fumigation was in excellent condition after more than two years. Heating of the grain, one cause of which is infestation by insects, does not occur in the general body of wheat stored in Victoria. The reasons for the restriction of infestation to the surface layers are not known, but a lethal factor, appearing with infestation and increasing in effectiveness with insect density, is involved; the moisture content, temperature, and concentrations of oxygen and carbon dioxide at the lower levels are not thought to be responsible.

In tests in 1942–43 the order of decreasing susceptibility to magnesite of various grain pests was found to be: *Laemophloeus minutus*, Ol., *O. surinamensis*, *C. oryzae*, *C. granaria*, *T. castaneum* and *R. dominica*. Three samples of shell-grit from Victoria proved inferior to magnesite and dolomite; their effectiveness was roughly proportional to their silica content. Treatment with inert dusts impairs the free-running properties of the grain, and the slope of the sides of a mass of grain containing 0·1–0·75 per cent. dust may be 8–10° steeper than that of untreated grain. In laboratory tests, dust barriers, 1 ft. in width, were very effective against crawling insects. In investigations in 1943–44 in which various inert dusts were applied to wheat at rates of 0·5 and 1 per cent. by weight and at relative humidities of 45 and 65 per cent. against *C. oryzae* and *R. dominica*, an activated alumina [aluminium oxide] of English origin gave the best results and was the only dust yet tested against adult insects that gave complete mortality of *R. dominica* in less time than was required for that of *C. oryzae*. Various magnesites and dolomites of Australian origin were comparable with similar dusts already in use, and Australian activated alumina was less effective than the best magnesites; various industrial residues included in the tests were of no value.

In experiments in 1942–43 on the fumigation of infested bagged wheat in stacks containing 2,050–2,800 bags, carbon bisulphide at a dosage of 1 gal. per 1,000 cu. ft. appeared to give complete mortality of insect pests in 18 hours, but the technique involved was complicated. Attempts to fumigate infested portions of a stack by surrounding their free surfaces with air-tight material were unsuccessful, the rate of diffusion being so great that a dosage of 1½ gals. per 1,000 cu. ft. was completely ineffective. In 1943–44, owing to an increase in the number of bag stacks infested by insects, chiefly *C. oryzae*, in South Australia and Victoria, an attempt was made to develop a simpler technique for fumigation. It was found that carbon bisulphide applied at the top of the stack would penetrate to the bottom, and that if the walls were air-tight, the rate of diffusion from the top was so slow that mortality was high throughout except in the superficial layers. High mortality in these layers can be obtained by allowing the enclosing material to project about 3 ft. above the top of the stack, but heavy infestations are generally confined to the lower half of the latter. The mixture of ethylene dichloride and trichlorethylene, at the rate of 3 gals. per 1,000 cu. ft., was rather less effective than carbon bisulphide. In commercial trials with the latter, infested stacks containing as much as 90,000 bushels of bagged wheat were successfully treated at a cost of less than ¼d. per bushel by draping the walls with air-tight fabric, distributing the fumigant over the top, and covering it with hessian for 24 hours. In experiments in 1942–43 on the sterilisation of stack sites with mineral-oil emulsions [*cf.* **31** 42], the value of including a toxic agent was confirmed, and a mineral-oil emulsion containing 5 per cent. dinitro-o-cresol (commercial grade) was found to be as toxic as a proprietary mineral-oil emulsion containing nitrated phenols, which was hitherto considered the best for general use. This proprietary emulsion and a proprietary tar-distillate emulsion were also satisfactorily used as dips for infested bags; the best results are given by immersing the bags for two minutes and stacking them wet for two days before drying. The effectiveness of the treatment increases with the air temperature.

The baking qualities of flour made from wheat fumigated with carbon bisulphide at rates of up to 3 gals. per 1,000 cu. ft. were found to be impaired in the early work with this fumigant, though there was some improvement after storage. In 1942–43, flour from wheat that had been treated at the rate of 1 gal. per 1,000 cu. ft. showed no appreciable deterioration, but this is not regarded as conclusive as the wheat was of poor quality. The baking qualities of flour from wheat with moisture contents of 9 and 10 per cent. that had been stored for three months at temperatures of 70, 90 and 105°F. were not impaired.

In studies of the bionomics of *R. dominica*, breeding took place only very slowly at 70°F. The upper limit of development appeared to be 92°F., when the moisture content of the wheat was 8·5 per cent., and 100°F. when it was 10·5 per cent. No development took place at temperatures above 100°F., although viable eggs were laid at 108°F. on wheat with a moisture content of 12 per cent. In 1943–44, a relative humidity of 44 per cent. was found to be more suitable for development than one of 32 per cent. ; under both conditions, more progeny were produced at 85°F. than at 80 or 90°F. Some adults survived for at least seven months, but most of the eggs were laid during the first 8–10 weeks. It was found in 1942–43 that *L. minutus* breeds successfully in whole wheat, broken wheat and pollard ; it could maintain itself on bran, but not on white or reduction flour. The life-cycle occupied about 28 days at 90°F., 40–50 at 80°F., and 80–100 at 70°F. In experiments at different temperatures on the loss of weight of wheat caused by adults of *R. dominica*, *C. oryzae* and *C. granaria* in a week, the maximum loss caused by *R. dominica* was equivalent to twice its own weight, at a temperature of 95°F., and that by the other two was 1·25 times their own weight, at temperatures of 90 and 80°F., respectively.

Infestation of stored wool by clothes moths in Brisbane and Sydney increased noticeably in 1942–43 [*cf.* **32** 139], but did not develop to the extent considered possible ; *Apanteles carpatus*, Say, which parasitises *Tineola bisselliella*, Humm., was present in fairly large numbers. In the autumn, the number of moths trapped on a large adhesive band in an untreated store at Brisbane fell very considerably. This reduction was maintained in 1943–44 and was attributed to increases in the numbers of the parasite and of the spider, *Uloborus geniculatus*, Ol., which ultimately destroyed most of the adults that emerged, and to a disease of the larvae. In further laboratory experiments in 1942–43 on control by solid fumigants or sprays that kill the larvae by fumigant action, the most satisfactory of the latter were neutral and middle oil and a proprietary spray. Neutral oil gradually lost its toxicity after about two months, but a fortnight's exposure to the others continued to give complete mortality until the end of the experiment, more than six months later. Naphthalene gave almost complete mortality after an exposure of one week, and its toxicity remained nearly constant for over six months, until the crystals had almost all vaporised. Solvent naphtha, orthodichlorbenzene and paradichlorbenzene all had high initial toxicity, but the first two lost their effectiveness after seven weeks and the last after nine. Creosote and cresylic acid were both toxic and fairly persistent, but the former stains the wool and the latter gives off objectionable fumes ; dieseline and a saturated solution of naphthalene in dieseline were of little value. The effectiveness of both neutral and middle oil was greatly reduced when they were diluted with 25 per cent. diesoline, but the original toxicity was largely restored by saturating the mixture with naphthalene ; middle oil was the most toxic and persistent material tested. Wool treated with either of the oils or the proprietary spray showed no undesirable residue or stain after scouring. In further tests in 1943–44 in which middle oil 43 and the proprietary spray were applied to isolated bales of greasy wool, the percentage mortality of larvae in the wool treated with the oil was five times as high as that in the other. Observations of the numbers of adults trapped on adhesive bands in wool stacks in stores that had and had not been sprayed with the proprietary material were begun in 1942–43 and continued in 1943–44. The immediate effect of the treatment was to reduce the population to about 1 per cent., and at no time during the observations did it exceed 3 per cent. of the initial population. The recommended dosage for middle oil is 1 pint per bale. In laboratory experiments in the first year with fumigants for use on scoured wool, saturated solutions of naphthalene in solvent or orthodichlorbenzene (at 70°F.), alone or diluted with an equal volume of kerosene, were tested and the orthodichlorbenzene treatments appeared the most promising, but in 1943–44 these and the solution of naphthalene in naphtha all gave complete mortality of larvae in treated bales after three weeks, and none left any undesirable stain or residue. A spray of 90/190 solvent naphtha saturated with naphthalene and applied at the rate of 1 pint per bale is recommended. During the construction of stacks of both greasy and scoured wool, commercial whizzed naphthalene should be spread on each tier of bales.

Of the insects that have been introduced into Australia against St. John's wort (*Hypericum perforatum*), only *Chrysomela* (*Chrysolina*) *hyperici*, Forst., and *Agrilus hyperici*, Crtz., were known to be established prior to 1942. Late in that year, however, and again in 1943–44, *C.* (*C.*) *quadrigemina*, Suffr. (*gemellata*, Rossi) was found to be well established at a place in Victoria in which it had been liberated in 1939. The other insects made good progress in both years in Victoria and New South Wales, and further liberations were made. In December 1943, consignments of *C. hyperici*, each comprising 20,000 adults, were sent by air to South Australia and to Tasmania, and one of 30,000 to New Zealand, where liberations were made at two localities. The status of *Teleonemia scrupulosa*, Stål, in south-eastern Queensland, where it had been introduced against *Lantana camara*, improved in 1943–44 [*cf.* **33** 32]; populations were high near a site where a liberation was made in 1940, and the Tingid was found to have spread over a distance of two miles. Some bushes in another site colonised at about the same time were reported to be almost completely defoliated, and adults collected there were released in other districts.

The weather in the spring and summer of 1942–43 was favourable to *Chortoicetes terminifera*, Wlk. Swarms were present by November in six outbreak centres in northern and central New South Wales and spread considerably, and a second generation was produced in December over the whole infested area, the adults migrating further south and east in January and February. In January, swarms were formed in two additional outbreak areas. Oviposition by the second-generation females was extensive, but, owing to dry conditions, the eggs had not hatched by June. Despite this, survival was high, and numerous swarms were produced in the spring by the concentration of late-instar nymphs in situations of the type considered, from the results of previous work, to be outbreak centres. An experiment in 1943–44, in which adults were confined in large cages over pasture artificially maintained in various conditions of growth, confirmed previous findings that mortality is highest on comparatively bare and on tall dense pasture, and lowest under intermediate conditions. In continued tests in fenced outbreak centres [*cf.* **32** 140], ploughing the bare ground of oviposition sites to stimulate pasture growth was found in the first year to be ineffective, since considerable bare areas remained and at the end of the year the soil was already becoming consolidated. There was no significant improvement in the second year. The results of experiments in that year on the control of the non-swarming populations of hoppers [**32** 140] in which the dosage of the standard bait was reduced to 30 or 15 lb. per acre were inconclusive. Laboratory experiments on the bionomics of *C. terminifera* were continued in 1942–43, when newly-hatched hoppers were reared at 110°F. [*cf.* **31** 46]. It was concluded that the optimum temperature for development and survival is near 100°F., and in another small experiment this temperature was more favourable than 95°F. Development was not completed at 105°F. The summer temperature at the surface of the bare sunlit soil of the infested areas often exceeds 130°F., and the young hoppers are therefore not likely to survive unless shade is available. The preferred temperature for basking adults and late-instar nymphs was 104°F., and that for young nymphs is probably lower.

Losses of potatoes by *Gnorimoschema operculella*, Zell., were heavy in 1942–43 and comprised more than 20 per cent. of the crop in the following season. In experiments on the control of the larvae on the haulms in the first year, sprays of basic copper arsenate gave promising results, but in the following year, the yield was doubled by spraying the foliage with phenothiazine [*cf.* next abstract]. Considerable differences in susceptibility of the tubers to attack were found in tests with 33 varieties of potato. Laboratory stocks of four of five parasites of *G. operculella* introduced from California during the year were successfully reared, and *Chelonus phthorimaeae*, Gah., became established in the field near Canberra. Further consignments of *Apanteles glomeratus*, L., and *A. rubecula*, Marsh., were received from England in 1942–43 for use against *Pieris rapae*, L. [*cf.* **32** 140]. Further liberations of *A. glomeratus* were made, and in the following season it was recovered in appreciable numbers from a field near Canberra. Consignments were sent to Queensland, Victoria and South Australia. In field tests of insecticidal dusts against *P. rapae* in 1943–44, magnesite with the addition of 6 per cent. nicotine sulphate was as effective as arsenical and derris dusts and also controlled the cabbage aphis [*Brevicoryne brassicae*, L.]. An attempt to introduce *Trichopoda pennipes*, F., from Florida against *Nezara viridula*, L., was unsuccessful in 1942–43, but in the following year adults from a further consignment were released near Canberra and at least one generation is thought to have developed there. In preliminary laboratory and field tests in 1943–44, DDT [2, 2-bis (parachlorphenyl)-1, 1, 1- trichlorethane] gave promising results against *N. viridula*. The Chinese race of *Comperiella bifasciata*, How., was introduced from California in 1942 against *Aonidiella aurantii*, Mask., on *Citrus* [*cf.* **31** 392], and reared in the laboratory, and consignments were sent to all the mainland States during 1942–44 ; it appears to have become established in New South Wales and South Australia. Two consignments of *Metaphycus helvolus*, Comp., were received from California in 1942 for trial against *Saissetia oleae*, Bern., and other Coccids. A laboratory stock was initiated, and small liberations were made in New South Wales in the same year and in various districts, chiefly in the eastern States, during 1943–44.

Infestation of peaches by *Cydia molesta*, Busck, in the Goulburn Valley, Victoria, was light in 1942–43, and a survey in December 1942 yielded no evidence that the introduced parasite, *Macrocentrus ancylivorus*, Rohw., had become established [*cf.* **31** 44]. A further consignment of the Ichneumonid, *Alomya debellator*, F., for trial against *Oncopera* spp. [*cf.* **32** 140] was received during the first year, but at the time of its arrival, hosts were not in a suitable stage for attack. *Tortrix postvittana*, Wlk., damaged grape-vines in the Murray Valley in 1943–44, the chief injury being caused by larvae feeding in the developing berries ; this was frequently followed by the development of mould. Elsewhere in the report (p. 28), it is stated that the larvae were also found on young shoots only a few days old and that they were subsequently observed on tick beans. In preliminary experiments to discover cheap and safe substitutes for carbon bisulphide for application to nests of *Iridomyrmex detectus*, F. Sm., solvent and crude naphtha were both effective when applied at the rate of 1 pint to every eight entrance holes, but paradichlorbenzene was ineffective, even at the rate of 2 lb. per nest.

The survey of the abundance of *Myzus persicae*, Sulz., and *Macrosiphum solanifolii*, Ashm. (*gei*, auct.), which transmit virus diseases of potato, was continued at Canberra in both years [*cf.* **32** 140]. Eggs of *Myzus persicae* were laid on peach in the autumn of 1942, and viviparous reproduction continued slowly throughout the winter on swede and cabbage. The first flight and the first mass flight were recorded on 24th August and 2nd October, respectively. Apterae appeared on potato on 9th September, and peak populations were reached on 22nd October, a month earlier than the previous year [**32** 141]. *M. persicae* was not observed on potato from mid-December to March, but a small autumn generation then appeared, and gave rise to winged migrants. The seasonal history followed a similar sequence in 1943–44. The course of infestation by *Macrosiphum solanifolii* in both years resembled that observed in 1941 [**32** 141]. Populations of both aphids on potato were low in 1942–43. A virus disease of cauliflower and swede, believed to be identical with the cauliflower mosaic [*Marmor cruciferarum* of Holmes] recorded in the United States and the broccoli mosaic recorded in England was reported near Canberra during 1943–44. The vector has been found to be *Brevicoryne brassicae* [*cf.* **31** 228].

HELSON (G. A. H.). **A preliminary Field Test of Insecticides against Potato Moth,** *Gnorimoschema operculella* **(Zell.).**—*J. Coun. sci. industr. Res. Aust.* **17** no. 3 pp. 179–185, 3 figs., 5 refs. Melbourne, 1944.

The results are given of a field experiment carried out near Canberra in 1943–44 to find a satisfactory insecticide for the control of *Gnorimoschema operculella*, Zell., which causes severe losses of growing potatoes in Australia every year. Heavy dosages of the various materials were used in order to ensure thorough coverage of the plants, and further tests will be necessary to determine the best rates of application under practical conditions.

The experimental plots were sprayed with 3 lb. phenothiazine, 6 lb. synthetic cryolite, 5 lb. basic copper arsenate, 10 lb. basic copper arsenate, or 3 lb. lead arsenate per 100 gals. water on 18th January and four times subsequently at intervals of 14 days, or with the last two sprays on 15th February, when the plants were in full flower, and twice subsequently at intervals of 14 days. A wetting agent was added to the phenothiazine and 5 per cent. sodium aluminium sulphate was used with the lead arsenate. Observations of damage to the foliage by the larvae made on the day before the first application and then at intervals for two months showed that there was a uniformly low infestation before the date of the first application, but that after this the amount of damage rapidly increased. The greatest increase occurred on the untreated plots and the least on those sprayed with phenothiazine. On the latter, there was an initial increase in damage between the first observation and the second (on 10th February), but after this the treatment reduced and finally eliminated further damage to the tops. All other treatments were significantly less effective than phenothiazine, but statistical analysis showed that the differences between plots sprayed with cryolite, lead arsenate and basic copper arsenate (10 lb.) and the untreated ones were highly significant, and those between the latter and the plots receiving the late schedule of 10 lb. basic copper arsenate and the normal one of 5 lb. were significant at the 1 and 5 per cent. levels, respectively. Phenothiazine gave almost complete protection throughout the growing period of the plants and enabled them to grow vigorously, with none of the bottom leaves or lateral shoots totally destroyed by larvae. Plants sprayed with cryolite were only slightly less vigorous, but attack of the lower leaves and lateral shoots occurred ; plants treated with the other materials were smaller since they suffered the loss of most of the large lower leaves and severe attack on the bottom laterals, but those receiving basic copper arsenate appeared to recover later in the season by producing new top growth and laterals faster than the larvae destroyed them. Untreated plants were almost completely defoliated by the end of the season. The increases in yield over that from the untreated plots bore a direct relation to the degree of protection of the leaves from attack. The total yield and yield of sound tubers in the plots treated with phenothiazine were outstanding; the increase of sound tubers over the controls was 113 per cent. The weight of potatoes damaged by the larvae was least on the plots treated with phenothiazine, and there was little difference in this respect between most of the other plots and the controls.

It is concluded that phenothiazine, which protected the foliage to a remarkable degree, probably also gave direct protection to the developing tubers, but that cryolite and lead arsenate did not.

BEDFORD (E. C. G.). **Continuous Rearing of the Silkworm.**—*J. ent. Soc. sthrn Afr.* **7** pp. 68–72, 2 refs. Pretoria, 1944.

It is proposed to establish *Compsilura concinnata*, Mg., in South Africa against *Euproctis terminalis*, Wlk., on pine trees, and since large numbers of the parasite will be needed for liberation in the field and *E. terminalis* is difficult to deal with in the laboratory, the silkworm (*Bombyx mori*, L.) was selected as the laboratory host. The Tachinid has 3–4 generations a year [*cf.* *R.A.E.*, A **25** 431], however, while the silkworms available in South Africa have only one, and experiments were therefore begun to overcome this difficulty.

Thousands of silkworm eggs that were obtained in October 1941 and were not expected to hatch for ten months included some, laid by one female, that hatched in 11 days. Most of the females obtained from them laid univoltine eggs, but a few belonged to a multivoltine strain, which was reared through four generations. Its life-cycle was completed in about eight weeks at a constant temperature of 70°F., but as the generations developed at a uniform rate, larvae of medium size, which are the ones attacked by the parasite, were present for only three weeks in each generation. In attempts to make them overlap, it was found that the duration of the larval stage could be extended from one to 2¼ months by rearing the larvae at 60°F. and that newly-hatched larvae could be kept in a dormant condition at 47°F. for ten days, development proceeding normally when they were returned to normal temperatures; newly-hatched larvae were killed by exposure to the low temperature for three weeks, but half-grown examples survived for 17–22 days.

Work with the multivoltine strain was discontinued because methods of accelerating or retarding the duration of the egg stage of the univoltine strain, which normally lasts ten months at room temperatures or about eight at 70°F., were discovered during the course of it. When dipped for five minutes in 90-100 per cent. hydrochloric acid, the October eggs hatched in 16–19 days at normal temperatures, eggs of the following generation hatched in 13–15 days in December, and those of the third and subsequent generations in 9–12 days. Ten minutes' exposure to the concentrated acid killed the eggs, but a solution of the acid in water (2 : 1 by volume) gave satisfactory results when the eggs were immersed in it for 15 minutes. The treatment was most successful when applied to eggs laid 12–24 hours previously, but could be used satisfactorily for those 2–48 hours old. Eggs treated half an hour or six weeks after deposition failed to hatch, as did 95 per cent. of those treated when three days old. Hatching of acid-treated eggs was delayed for 11 weeks by keeping them at 70°F. for four days after treatment and then at 35°F. for two months; they began to hatch 12 days after removal from cold storage. The rapidity with which the eggs hatched after cold storage varied directly with the period for which they had been kept at 70°F.; of a batch exposed to 70°F. for eight days, many hatched while still in cold storage and others on the day on which they were removed from it. Placing the eggs in cold storage and then treating them with hydrochloric acid before removing them to the higher temperature was unsatisfactory.

In other experiments, eggs not subjected to acid treatment were kept for short or long periods first at 70°F. and then at various low temperatures (21–47°F.). The shortest duration of the egg stage was obtained by exposure to 70° and 47° for 2½ and four months respectively, all the eggs hatching 11–22 days after removal from cold storage. The length of the egg stage was extended to only a few days less than a year by exposure to 70° and 47° for 2·3 and nine or 7·25 and four months, respectively. Only 50 per cent. of the eggs survived in the latter case, and none survived exposure to 47° for more than nine months.

The duration of the pupal stage averaged 15·6 days at a constant temperature of 70°F. It was increased to five weeks by keeping the pupae at 60°F., but the mortality was 33 per cent. When pupae one week old were kept at 47°F. for two weeks and then at 70°F., a few died, and the adults that developed from the rest were weak and deformed ; emergence occurred after about a month.

The silkworms were fed on lettuce leaves during the winter when mulberry leaves were not available. Those that had been subjected to cold storage in the egg stage completed their development on lettuce alone, though they spun little or no silk before pupating, but larvae of the multivoltine strain died in the fifth instar when reared on lettuce. Silkworms transferred from lettuce to mulberry in any of the first four instars developed normally and spun strong cocoons.

The procedure finally devised to ensure a continuous supply of larvae of a size suitable for parasitism involves the rearing of only two generations of silkworms a year, in March and September. The eggs produced by each generation are kept at 70°F. for two months and then at 47°F. for 4–9 months. Eggs removed from cold storage at any time after four months begin hatching 11–14 days later.

Rivnay (E.). **The economic Status of** *Coccus hesperidum* **L. and its Parasites in Palestine.**—*J. ent. Soc. sthrn Afr.* **7** pp. 73–81, 6 refs. Pretoria, 1944.

Of the numerous food-plants of *Coccus hesperidum*, L., in Palestine a list of some of which is given, the most important economically is *Citrus*, but the injury caused to it is not great. Isolated females sometimes occur on the leaves and young twigs throughout a grove without causing any important damage, but sometimes the young nymphs attack the young fruits below the sepals near the junction with the stem, causing many to wither and drop prematurely. Infestation of both these types may pass unnoticed, but in a third, the twigs become densely covered with the Coccids, though as a rule only a few trees are affected and the attack is quickly controlled by natural enemies. The high temperatures that occur in Palestine and the low humidities, particularly that produced by the dry winds in spring, are unfavourable to *C. hesperidum*, and its numbers usually increase only in late May and early June and towards autumn, except in shady situations or in greenhouses. When more humid conditions in spring enable the population to increase, natural enemies afford control.

The most important of the parasites is the Encyrtid, *Eucomys lecaniorum*, Mayr, which is widely distributed in Palestine, and was bred from *C. hesperidum* on *Citrus* and four other plants. It usually parasitises the larger individuals ; the percentage parasitism in a dense infestation in June 1940 was at least 83, whereas among isolated females in March 1942 it was only 6. Development was completed in 18 days in the laboratory at temperatures varying from 21 to 30°C. [69·8–86°F.] and averaging 25°C. [77°F.]. An unidentified species of *Encyrtus* and *E.* (*Microterys*) *frontatus*, Merc., were reared from *Ceroplastes floridensis*, Comst., and *Coccus hesperidum* in the southern part of the coastal plain and were sometimes quite numerous, and two examples of a species tentatively recorded as *E.* (*M.*) *consobrinus*, Merc., were bred from *Coccus hesperidum*. Other Encyrtid parasites of this Coccid were *Diversinervus elegans*, Silv., which was also obtained from *Ceroplastes floridensis*, *Blastothrix erythrostethus*, Wlk., and *Metaphycus* (*Aphycus*) *flavus*, How., but they were of no importance. Three unidentified Aphelinids of the genus *Coccophagus* were reared, one in large numbers from *Coccus hesperidum* on *Citrus* and mango, chiefly from dense infestations of the younger stages, and the two others in very small numbers from this Coccid on *Acacia longifolia*. *Coccophagus scutellaris*, Dalm. (*lunulatus*, How.) and *Scutellista cyanea*, Motsch., which had been recorded from *Coccus hesperidum* in Palestine, were not bred from this host by the author, but the latter was reared from *Saissetia oleae*, Bern., *S. coffeae*, Wlk. (*hemisphaerica*, Targ.), *Ceroplastes floridensis*, and *C. rusci*, L. The hyperparasite, *Pachyneuron coccorum*, L., was reared several times from *Coccus hesperidum* on *Citrus*, in association with *B. erythrostethus* and *Eucomys* in one locality, and once from this host on *Acacia longifolia*, on which it was associated with *Coccophagus*. The predacious Noctuid, *Eublemma scitula*, Ramb., feeds actively on *Coccus hesperidum*, but is too rare in Palestine to be of economic value.

OOSTHUIZEN (M. J.). **The Treatment of Potato Tubers with Carbon Bisulphide and with Para-dichlorobenzene.**—*J. ent. Soc. sthrn Afr.* **7** pp. 100–109, 2 pls., 12 refs. Pretoria, 1944.

In experiments carried out in South Africa in 1942, tubers of a late variety of potato, some of which were infested by larvae of *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., and of an early variety, were fumigated in lots of 5 lb. with carbon bisulphide at rates of 2, 4 and 6 lb. per 1,000 cu. ft. for 24 and 48 hours in galvanised iron tanks. The treatment was carried out one or two months after harvesting of the late variety and two weeks after harvesting of the early one. All treatments destroyed the larvae. There was little or no injury to the tubers from treatment with 2 lb. carbon bisulphide for 24 or 48 hours, and very slight injury from treatment with 4 lb. for 24 hours, but most of those subjected to the other three treatments had decayed within a month. Very high relative humidity was recorded, soon after fumigation began, in the tank in which tubers were subjected to the highest rate, and it is concluded that the carbon bisulphide increased their respiration. The temperature varied between 37 and 60°F. It is suggested that the higher dosages might be less injurious if the fumigation were carried out under tarpaulins. Fungi developed on sections of tubers kept under observation following all treatments, except, in the case of the late variety, exposure to 2 lb. for 24 hours ; the decreases in weight after 50 days in sections of tubers exposed to this dosage for 24 and 48 hours were 31 and 52 per cent., respectively, as compared with 28 per cent. in controls, and for the higher dosages they varied from 57 to 79 per cent.

Carbon bisulphide is commonly used in South Africa to accelerate sprouting, and it was found that fumigation at 2 lb. per 1,000 cu. ft. for 24 or 48 hours or 4 lb. for 24 hours did so in all tubers of the late variety. In the case of the early variety, however, sprouting was retarded either because the dormant stage was passed or because the tubers were treated too soon after harvest.

In experiments in 1943 to ascertain whether paradichlorbenzene is injurious to dormant as well as to sprouting tubers, dormant tubers of the late variety were fumigated in small, fairly gas-tight glass containers immediately after harvest and after intervals of 1½ and about 3 months at dosages equivalent to 7·7, 10 and 16·5 lb. per 1,000 cu. ft. for periods of 1–2 weeks. Owing to low temperatures, crystals were still present at the end of the treatment, but the tubers absorbed a considerable amount of the vapour. Healthy shoots had appeared on all tubers five weeks later, except those exposed immediately after harvest, and these produced shoots after a further 3½ weeks. In a comparative test in which sprouting tubers and a few that were dormant were fumigated for periods of 1, 2 and 7 days at 77°F., all the shoots had collapsed at the end of treatment. After a further 11 days at the same temperature, secondary shoots up to ½ in. in length had developed on tubers exposed for the shorter periods, and shoots were developing on a few of those exposed for the longest one.

FAURE (J. C.). **Pentatomid Bugs as human Food.**—*J. ent. Soc. sthrn Afr.* **7** pp. 110–112. Pretoria, 1944.

" MJELE." *Haplosterna delegorguei* (**Order Hemiptera**).—*T.c.* pp. 113–114.

It is recorded in the first of these papers that the Pentatomid, *Encosternum* (*Haplosterna*) *delegorguei*, Spin., is used as food by native tribes in the eastern Transvaal, and in the second that it is similarly eaten in Southern Rhodesia. Both contain notes on its habits.

OOSTHUIZEN (M. J.). **Protection of stored Grain by means of Dusts.**—*Fmg in S. Afr.* 1944 repr. no. 45, 9 pp., 5 figs., 9 refs. Pretoria, 1944.

The author describes methods used by native tribes in South Africa for protecting stored grain from infestation by insects and gives the results of experiments in the Transvaal in 1936–37 to determine the effect of various dusts on *Calandra oryzae* L., in stored maize and *Bruchus* (*Callosobruchus*) *chinensis*, Thnb., in cowpeas.

In the first series, lime, kaolin, magnesium oxide, flowers of sulphur, wood ash (*Acacia karroo*), ash of aloe leaves (*Aloe aculeata*), dry crushed leaves of *Datura stramonium* and *Tagetes minuta* and a proprietary dust were mixed with samples of 200 gm. maize (moisture content 10 per cent.) at rates of 1, 2 and 4 gm. per sample, and copper carbonate was used at rates of 0·8, 0·4 and 0·2 gm. Each sample was artificially infested with 50 weevils one month old and kept in a jar with a screen lid for 96 days, after which it was examined for weevils and loss in weight of grain. Copper carbonate resulted in complete mortality of the weevils, and lime (2 : 100 and 1 : 100) and aloe ash (2 : 100) reduced their increase significantly more than the other dusts, which appeared to be of little or no value. The loss in weight of the grain was insignificant in samples treated with lime or wood or aloe ash and 5 per cent. in the untreated grain.

In the second series of experiments, samples of 300 gm. cowpeas, with a moisture content of 9 per cent., were treated with 4 or 6 gm. lime or kaolin, 1·5 or 3 gm. magnesium oxide, 0·3 or 0·6 gm. barium or sodium fluosilicate, 0·6 or 1·2 gm. sodium fluoride, cryolite, Paris green, calcium arsenate or copper carbonate, or 6 or 12 gm. sodium chloride (common salt), were infested with 60 newly emerged Bruchids and kept at a constant temperature of 26·5°C. [79·7°F.] for 4½ months. No treatment gave complete mortality, and common salt proved ineffective in reducing increases in the Bruchid populations, but all the other treatments were highly effective, with no significant difference between them. There was no appreciable loss of weight of the seed in the case of the effective treatments, but 38 per cent. loss in untreated seed ; 94 per cent. of the seed treated with lime germinated, as compared with only 4 per cent. of untreated seed.

In a later experiment, samples of 100 gm. cowpeas were treated with 0·25–2 gm. kaolin, infested with 30 newly emerged Bruchids and kept at 26–28°C. [78·8–82·4°F.] for 2½ months. All treatments effected considerable reductions in breeding and in the decrease in weight of the seed ; 1 and 2 gm.

kaolin were highly effective, but 0·75 gm. was less so than 0·5 gm., presumably owing to poor mixing of dust and cowpeas, and 0·25 gm. was much less effective.

The methods of applying the dusts, their mode of action [*cf. R.A.E.*, A **32** 38–40] and the factors determining their effectiveness, including particle size, moisture content of the grain, relative humidity of the atmosphere, temperature, and species, size and age of the insects are discussed. It is concluded that the more effective of the dusts tested may be of considerable value in limiting the breeding of weevils and Bruchids. The dosage recommended for grain in bulk is 1–2 per cent. by weight of inert dust or 0·2–0·4 per cent. of poisonous dust. Dusts are considered unlikely to be effective in the damp coastal regions of South Africa, as increases in the moisture content of the grain or the relative humidity of the air reduce their efficiency. Since kaolin, lime and magnesium oxide are widely used in medicine, it is considered unnecessary to remove them from the grain before it is used for food, but copper carbonate and the arsenicals and fluosilicates should be used only to protect grain intended for seed.

Paillot (A.), Kirkor (S.) & Granger (A. M.). **L'Abeille. Anatomie, maladies, ennemis.**—2me éd., 188 pp., 53 figs., refs. Trévoux, G. Patissier, 1944.

This book consists of four parts devoted to the anatomy and bionomics of the hive bee, diseases and disorders affecting the adults and the brood, and natural enemies. The diseases dealt with include acarine disease, caused by infestation by *Acarapis woodi*, Rennie, and there is a section on poisoning by insecticides. The part on natural enemies contains information on insect parasites and predators that attack the adults, and insects that feed on the honey, wax and pollen in the hives.

Papers noticed by Title only.

Service and Regulatory Announcements, January–March 1945 [including a summary of plant quarantine restrictions on imports into Antigua].—*S.R.A., B.E.P.Q.* no. 162 pp. 1–17. Washington, D.C., U.S. Dep. Agric., 1945.

Guénaux (J. [*i.e.* G.]). **Entomología y parasitología agrícolas. Versión española de la quinta edición francesa revisada y aumentada por José del Cañizo.** [Agricultural Entomology and Parasitology. Spanish Version of the fifth French Edition revised and augmented by José del Cañizo.]—xx+664 pp., 427 figs., refs. Barcelona, Salvat Edit., S.A., 1943. Price *Ptas.* 58. [Recd. 1945.] [*Cf. R.A.E.*, A **6** 134.]

Tuft (P. H.). **Some Modifications of Procedure when using Eggs of *Aphis pomi* (De Geer) for the biological Evaluation of Insect Ovicides.**—*31st Rep. E. Malling Res. Sta. 1943* pp. 67–68, 2 refs. East Malling, 1944. [*Cf. R.A.E.*, A **26** 297.]

André (M.). **L'hivernation chez les tétranyques** [*Tetranychus* and *Paratetranychus*] **et ses rapports avec la lutte contre ces acariens phytophages** [a review of the literature].—*Bull. Mus. nat. Hist. nat.* (2) **14** no. 1 pp. 57–62, 12 refs. Paris, 1942. [Recd. 1945.]

[Shtakel'berg (A. A.).] Stackelberg (A. A.). ***Turanodinia coccidarum* gen. sp. nov. (Diptera, Odiniidae), a new Predator** [reared from egg-masses] **of *Pseudococcus comstocki* Kuw. (Homoptera, Coccoidea)** [in Uzbekistan].—*C. R. Acad. Sci. URSS* (N.S.) **44** no. 3 pp. 126–127, 1 fig. Moscow, 1944.

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